CLINICO DEMOGRAPHIC PROFILE OF UTI IN CHILDREN

BETWEEN 2 – 12 YEARS AND

ANALYSIS OF FACTORS PREDISPOSING TO

UTI

Dissertation submitted to

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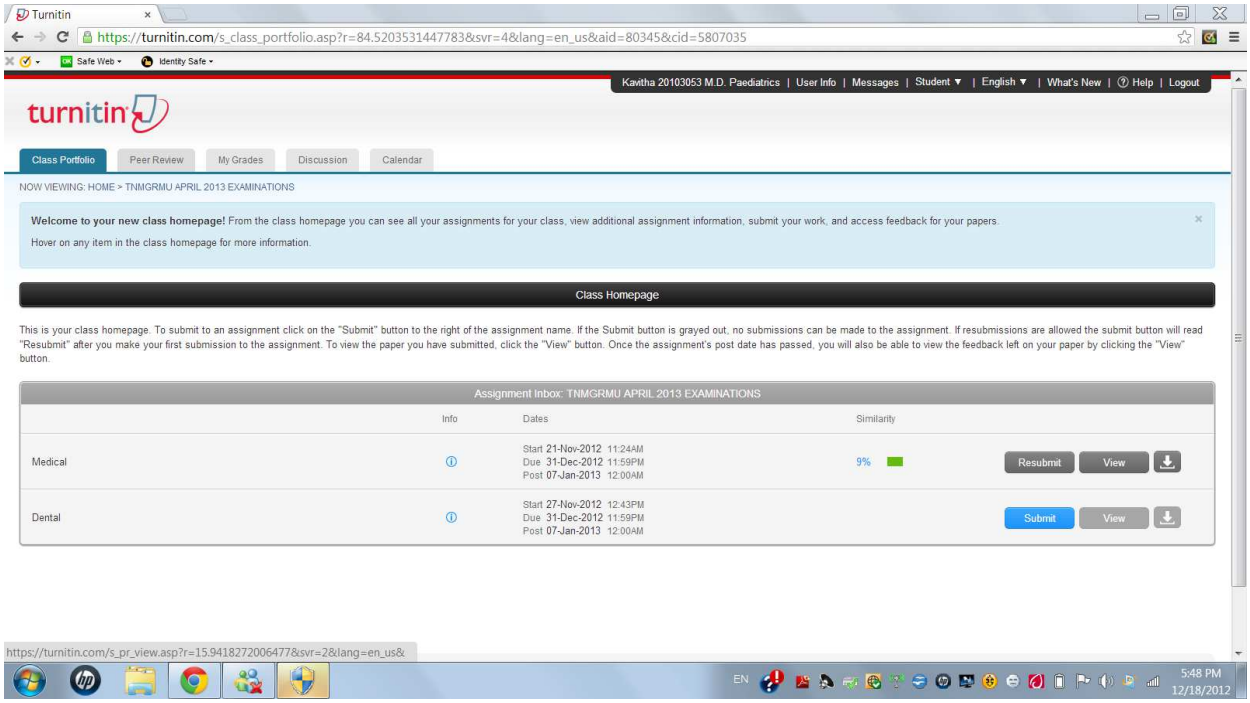

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CONTENTS

Introduction

Worldwide in paediatric age group urinary tract infection remains as silent yet very frequently faced infection. It produces significant mortality and morbidity among paediatric population due to inconspicuous clinical manifestations. It results in significant morbidity by producing irreversible damage to renal system that can never be salvaged if not recognised and treated early. Hence early recognition of subtle symptoms and signs will definitely provide good outcome among patients suffering from urinary tract infection.

The etiology that predisposes to UTI is not very clear as not many studies are available worldwide to find the exact risk factors. If exact risk factors are known knowledge about prevention of risk factors helps in the management of urinary tract infection as well as prevents recurrence. The risk factors of UTI depend on socioeconomic status and cultural habits like perineal cleaning methods and diaper usage. So it is better to analyse the risk factors in specific cultural groups of different places so that the risk factors which are differing from population to population can be identified and different strategies can be formed for population with different cultures.

Hence this study is undertaken to assess the clinical, demographic profile of UTI patients in a hospital which is catering to lower socioeconomic group which comprises majority of labourers and analyse the risk factors which predisposes to UTI in this specific population.

Review of literature

Urinary infection is one of the common infections occurring in children. Different literature says different definition for UTI. Indian academy of paediatrics defines urinary tract infection as growth of significant number of organisms of single species in urine culture with presence of symptoms of UTI. Positive urine culture is a primary requirement to diagnose urinary infection.

Incidence

Incidence of UTI among of boys is 1% and girls is 3-5% .[1] Risk of having UTI in first 14 years of life is 1-3% in boys and 3-10% in girls.[2, 3] Ratio of incidence of UTI during 1st year of life between male and female is 2.8-3.4:1. Beyond 1year there is female preponderance with male female ratio of 1:10. [1] Age wise incidence of UTI according to few studies is as follows [4, 5, 6, 7, 8]

TABLE 1 - INCIDENCE

AGE IN YEARS	FEMALE	MALE
<1	0.7%	2.7%
1-5	0.9-1.4%	0.1-0.2%
6-16	0.7-2.3%	0.04-0.2%
18-24	10.8%	0.83%

Etiopathogenesis

Most of the urinary infections are mono microbial. E. coli is the most common organism except in neonates where it is Group B Streptococcus.[9] In case of immunocompromised patients and patients with indwelling catheters Candida growth can occur.[10] E. coli growth is mainly because colonic bacteria are the major cause of UTI.[1] E. coli is closely followed by Klebsiella and Proteus.[1] Proteus is common in boys and children with renal stones.[11] Other uropathogens are as follows[12]

Gram positive cocci

Enterococcus spp.

Staphylococcus aureus

Staphylococcus epidermidis

Staphylococcus saprophyticus

Streptococcus fecalis

Group D Streptococcus

Gram negative cocci

Neisseria gonorrheae

Gram negative rods

Pseudomonas

Enterobacter cloacae

Morganella morganii

Providentia stuarti

Serratia spp

Others

Chlamydia

Adenovirus

Clonal studies of the bacteria causing urinary infection supports the fact that UTI is caused by transmission of bacteria by faeco perineal urethal route and then further ascent into bladder.[13]

The major defence against urinary infection is antegrade flow of urine. The organisms are washed out because of flow of urine.[14] Also urine has specific characteristics against growth of organisms including low pH, polymorphonuclear cells and Tamm-Horsfall glycoprotein. These inhibit bacterial adherence to mucosa.[15]

These defences are overcome by bacterial virulence factors.[16-18] E. coli adheres to uroepithelium with the help of adhesins often fimbriae which binds to specific receptors in the urothelium.[17-19] The organism is then internalised into epithelial cells which leads to apoptosis, hyper infection and invasion into the surrounding epithelial cells or an establishment of bacterial focus and forms a base for recurrent UTI where drugs cannot reach the focus.[18-20]

E. coli also release toxins which cause cell destruction, cell cycle arrest and change in cellular morphology and function.[21, 22] Toxins include cytolethal distending toxin, alphahemolysins, cytotoxin necrotising factor-1 and secreted autotransferace toxin. E. coli also has a glycosylated polysaccharide capsule that interferes with phagocytosis and complement mediated destruction.[23]

Certain other organisms have siderophore systems that acquires iron from heme which is an essential bacterial micronutrient.[24]

Bryant and colleagues found that overall incidence of Candida to be 0.5%.[25] In another study Phillips and Karlovics found it to be 42%.[10]

Risk factors

Risk factors for urinary infection are as follows[1]

Female gender

Uncircumcised male

Vesico ureteric reflux

Toilet training

Voiding dysfunction

Obstructive uropathy

Urethral instrumentation

Wiping back to front in females

Tight underclothing

Pinworm infestation

Constipation

Anatomic abnormality

Neuropathic bladder

Two studies supported bladder instability, constipation and infrequent voiding as risk factors of UTI.[26, 27] Bubble bath and wiping back to front have not been demonstrated as risk factors.

Inappropriate use of antibiotics for other than urinary infections and for any prophylaxis leads to increased risk of developing symptomatic urinary tract infection.[28, 29]

Vesico ureteric reflux is an important risk factor for UTI. 1% of children have vesico ureteric reflux and it is mostly congenital and run in families.[1] 40-50% of infants and 30-50% of children presenting with urinary infection have reflux but it resolves with age. Risk of scarring and injury leading to reflux nephropathy is increased in first year of life.[31] In case of intrauterine vesico ureteric reflux baby develops renal hypoplasia or dysplasia.[32]

Risk factors for fungal UTI are long term antibiotic use, indwelling catheters, immunosuppression, post transplant patients and parenteral nutrition.

Clinical features

Urinary tract infection is considered as one of the important causes of fever without focus[33, 34] especially in children less than two years of age. Young children present with recurrent fever, diarrhoea, vomiting,

abdominal pain and poor weight gain. Abdominal pain and fever are the common presentation in children between two to five years.[35] In more than five years children classical urinary symptoms like urgency, frequency and dysuria occurs.[35] Pyelonephritis is characterised by flank pain, fever, nausea, malaise and vomiting.[1]

As per Indian Academy of Paediatrics guidelines distinction between upper and lower urinary tract infection is difficult and often unnecessary. In view of significant parenchymal damage occurring if urinary tract infection diagnosis and treatment is delayed, all children with urinary tract infection is considered as having upper UTI and treated promptly.

Urinary tract infection is classified into simple and complicated UTI.[36]

Simple urinary tract infection is one where there occurs significant bacteriuria with symptoms of urinary infection. Significant bacteriuria is colony count of $>10^5$/ml of single species in midstream clean catch urine sample's culture.[36]

Complicated urinary tract infection is one where there occurs systemic toxicity, persistent vomiting, dehydration, renal angle tenderness and raised creatinine along with features of simple UTI.

Malodorous urine is not helpful in diagnosing UTI.[1, 37]

Diagnosis

Diagnosis of urinary tract infection is made on the basis of urine culture. Urine culture reports depend on the method of urine collection. A clean catch midstream specimen is used to minimise contamination by periurethral flora. It can further be reduced by washing with soap and water before sample collection. However most studies have failed to demonstrate the benefit of cleansing with soap and water.[1] Antiseptic wash not to be used.

Other methods are catheterisation and collection and supra pubic aspiration. These methods are mainly used in infants and neonates and are easy and safe.[38] Supra pubic aspiration has variable success rates ranging from 23-90%[39, 40, 41] and can be improved with ultra sonogram guidance.[42,43] Catheterisation and collection of urine has sensitivity of 95% and specificity of 99% when compared to supra pubic aspiration.[40, 44, 45]

Urine has to be plated within 60 minutes of collection to prevent growth of commensal organism. If there is anticipated delay in plating urine can be refrigerated at 4 degree Centigrade for 12-24hrs.

Significant bacteriuria in different methods of urine collection is as follows[3,33,36]

TABLE 2 – SIGNIFICANT URINE CULTURE

METHOD	SIGNIFICANT GROWTH	SENSITIVITY
Midstream clean catch	$>10^5$ CFU/ml	90-95%
Catheterisation	$>5 \times 10^4$ CFU/ml	95%
Supra Pubic Aspiration	Any number	99%

Culture is repeated if contamination is suspected that is if there is mixed growth of organisms or growth of organism that normally constitute periurethral flora like Lactobacillus in healthy girls and Enterococcus in infants and toddlers.

Urine analysis enables only a provisional diagnosis and so a specimen has to be taken for urine culture prior to therapy.[38]

Clear urine has 96-100% negative predictive value in cohort studies but it is unreliable with dilute urine. (SG <1.005)[46, 48, 49]

Rapid tests include dipstick analysis for leukocyte esterase and nitrites which will be positive in infected urine although false negatives can occur in dilute urine.[1] This test can be used as a screening for urinary

tract infection.[2] In a study of cohort with 18% prevalence of UTI a negative result on dipstick analysis had a negative predictive value of 96% which is more accurate than analysis of pyuria by microscopy in children[46, 47] although debated.[50] Certain authors say that urine culture is indicated only if urine is cloudy or dipstick for leukocyte esterase or nitrite activity is positive.[46, 47, 48, 49]

Proteinuria can occur and can be detected by dipstick or heat coagulation method.

Significant pyuria is defined as >10 leukocytes/**cu.mm** in a fresh uncentrifuged sample or >5 leukocytes/**hpf** in a centrifuged sample. WBC casts may also be seen. Urinary tract infection can occur without pyuria and pyuria without urinary infection.[1]

Sterile pyuria defined as leukocytes in urine with negative urine culture can occur in partially treated UTI, viral infections, renal tuberculosis, renal abscess, urinary infection with obstruction in urinary tract, interstitial nephritis,[1] any fever, glomerulonephritis, renal stones and foreign body in urinary tract. Accuracy of positive findings in the above said tests are as follows[53]

TABLE 3 – URINE ANALYSIS

TEST	SENSITIVITY	SPECIFICITY	PROBABLITY OF UTI
Bacteria on Microscopy	81%	83%	35%
Leukocyte on microscopy	73%	81%	30%
Leukocyte esterase on dipstick	83%	78%	30%
Nitrite activity on dipstick	53%	98%	75%
Leukocyte esterase and nitrite activity	93%	72%	27%
Protein	50%	76%	19%
Blood	47%	78%	19%

The presence of bacteria in high power magnification represents $3X10^4$ bacteria/ml.[51] Hobermann and Walt had reported that pyuria and

bacteriuria has as high as 84.6% positive predictive value but because of low sensitivity. Negative urine microscopy does not rule out urinary tract infection.[52]

Hematuria can occur in cystitis.

Complete blood count may show leukocytosis with neutrophilia and inflammatory markers like C reactive protein and Erythrocyte sedimentation rate may be elevated.[1] In case of renal abscess WBC count shows marked elevation to 20,000 – 25,000/cu.mm.[1] Blood cultures are often not necessary. It is more likely to be positive in case of Staphylococcus aureus and Group B Streptococcal infection.[54, 55]

Treatment

General measures include adequate fluid intake, frequent voiding and treating constipation.[3, 33] Double voiding ensures adequate emptying of bladder of post void residual urine. “Drink plenty and don’t hold on” was propagated by NICE. Children must be advised to take sufficient fluids in frequent small amounts.[30]

Circumcision reduces the risk of recurrent urinary tract infection in boys and so found beneficial.[56, 57] Worm infestation if present has to be treated.

Patient has to be hospitalised if <3 months old, complicated urinary tract infection, not able to take orally because of vomiting or there is suspicion of urosepsis.[1]

Acute cystitis has to be treated immediately because of the risk of pyelonephritis in these patients.

Empirical antibiotic with ceftrioxone or ampicillin with an aminoglycoside can be started after taking urine sample for culture and sensitivity.[1] Antibiotic has to be chosen according to the prevailing culture and sensitivity pattern in our area and has to adjusted with the report and clinical response later if needed.

Parenteral drugs can be switched to oral after two to three days when child improves and starts taking orally. Non toxic child taking orally can be started on oral drugs like trimethoprim-sulfamethoxazole, nitrofurantoin or a third generation cephalosporin.[1] Ciprofloxacin can be used for more than seventeen years patients and in young children with cystic fibrosis and pulmonary infection with pseudomonas suspicion.[1]

Duration of therapy is three to five days in case of simple urinary tract infection and ten to fourteen days in case of pyelonephritis.[1] Indian Academy of Paediatrics recommends ten to fourteen days therapy in case

of complicated urinary tract infection and seven to ten days therapy in case of simple urinary tract infection.[36, 33]

In a study in children older than two years short courses of three to five days treatment is adequate because longer course of oral antibiotics have not been efficacious.[58] In a randomised control trial comparing oral and parenteral regimens in children with febrile urinary tract infection there was no difference.[59, 60] In another study on treatment regimens of UTI short courses of three to five days may be effective as longer courses of seven to fourteen days but not clearly proved.[61, 62, 63] Another study states once daily parenteral administration of gentamycin or ceftrioxone in a day care treatment centre was found to safe effective and cost effective in children with urinary tract infection.[64, 65]

Routine repeat urine culture to prove clearance of infection is not recommended.[66] urine culture has to be repeated only if there is no response for seventy two hours of adequate antibiotic therapy.

In case of children with perinephric or renal abscess or infection in obstructed urinary tract surgical drainage has to be done along with routine treatment.[1]

Imaging studies

There is debate regarding the need and intensity of imaging studies in children.[2, 67] Imaging studies is done in children to detect any anatomical abnormality that is predisposing to urinary infection.[1] Available modalities are as follows

- ✓ **USG** – Renal ultra sonogram to look for kidney size, number, location, hydronephrosis, urinary bladder anomalies and post void residual urine
- ✓ **DMSA scintigraphy** – Dimercapto succinic acid scintigraphy to look for renal parenchymal infection and renal scarring
- ✓ **VCUG** – Voiding cysto urethrogram to look for vesico ureteric reflux and anatomic details regarding bladder and urethra
- ✓ **Radio nucleotide cystography** – used in follow up of patients with vesico ureteric reflux
- ✓ **Cystoscopy** – contraindicated nowadays because they contribute nothing to the therapeutic decisions taken in treating urinary tract infection.[1]

Renal ultra sonogram has to be done in cases of febrile urinary tract infection to look for inflamed and enlarged kidneys.[1] Indian Academy of Paediatrics recommends renal USG for all patients with urinary tract infection.

Voiding cysto urethrogram indications are changing nowadays. It has to be done in girls with two to three episodes of urinary tract infection in six months and in boys with second episode.[1] It is also indicated if there is abnormalities in renal ultra sonogram like hydronephrosis, disparity in renal length or bladder wall thickening.[1] In 40% of patients with urinary tract infection vesico ureteric reflux is identified and only 40% of patients with vesico ureteric reflux have USG abnormality.[1] Indian Academy of Paediatrics recommends that VCUG has to be done in all infants and in children less than five years of age if DMSA is abnormal and in children more than five years if USG shows abnormality.

Dimercapto succinic acid scintigraphy is done when diagnosis of acute pyelonephritis is uncertain and to look for renal scarring in case of reflux.[1] Indian Academy of Paediatrics recommends DMSA scan to be done in all children less than five years of age and in children more than five years only if renal ultra sonogram shows abnormality.

1999 clinical practice guidelines from American Academy of paediatrics[68] recommended imaging for children aged two months to two years of age but recent evidence suggest no improvement in patient care. Renal ultra sonogram does not change the management of urinary tract infection in prospective study.[69]

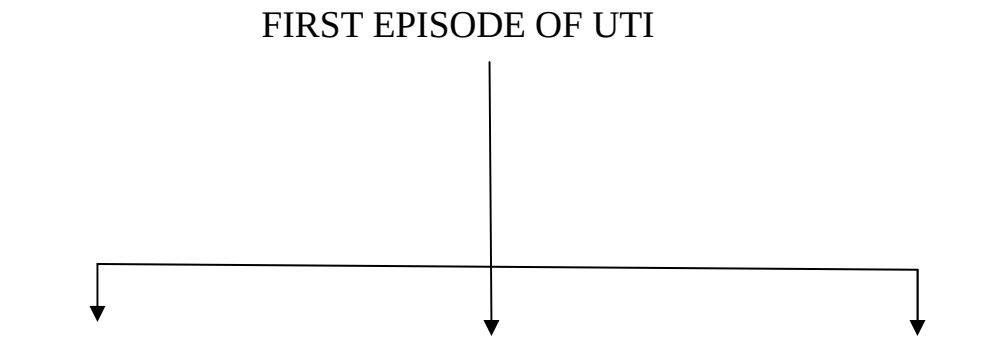
In a randomized control trial routine imaging increased the use of prophylactic antibiotics but did not reduce the rate of recurrent urinary infection or renal scarring at two years.[70] Extensive imaging workup including renal ultra sonogram at seventy two hours, voiding cysto urethrogram at one month and repeat renal ultra sonogram at six months in a prospective study of three hundred and nine children with urinary tract infection did not change the management. The manner in which vesico ureteric reflux or renal scars alter the course of management is controversial.

Some authors suggest that vesico ureteric reflux predisposes to recurrent pyelonephritis and hence renal scarring.[71, 72] It is recommended to diagnose vesico ureteric reflux early without adequate studies showing that interventions prevent renal scarring and hypertension. Severe vesico ureteric reflux has been associated with recurrent urinary tract infection and pyelonephritis[74] but direct association with renal scarring is inconsistent.[75, 76]

According to American Academy of Paediatrics renal ultra sonogram is indicated during first two days of treatment of febrile urinary tract infection to identify serious complications. Voiding cysto urethrogram is not routinely performed according to American Academy of Paediatrics

and is done only if renal ultra sonogram reveals hydronephrosis, scarring or any other finding suggestive of high vesico ureteric reflux.

Effective antenatal ultrasound and follow up has reduced the use of imaging workup following urinary tract infection in children in western countries. Contrarily in our country there is only limited resources and infrastructure and also antenatal ultra sonogram is not that effectively implemented and so imaging studies following urinary infection is recommended by Indian Academy of Paediatrics. The protocol is



<1 YEAR	1-5 YEARS	>5 YEARS
➢ USG	USG	USG
➢ DMSA	DMSA	DMSA and
➢ VCUG	VCUG if any abnormality in above two	VCUG if any abnormality in USG

Renal ultra sonogram is done soon after diagnosing urinary tract infection.

Voiding cysto urethrogram is done two to three weeks later.

Dimercapto succinic acid scintigraphy is done two to three months later.

Now studies have shown that VCUG can be done during the treatment of urinary tract infection in the course of hospital stay itself and need not be delayed.[1]

Recurrent UTI

Any second episode of urinary tract infection is considered as recurrent UTI. It is defined as recurrence of symptoms and signs of urinary infection with significant bacteriuria in patients who have recovered clinically following treatment of an episode of UTI.[36]

It is classified into three[77]

- Unresolved bacteriuria – all cultures are +ve for same organism
- Bacterial persistence – cultures are +ve for same organism after the urine becomes sterile
- Re infection – cultures are +ve for different organism after the urine becomes sterile

The most common cause for unresolved bacteriuria is inadequate antibiotic therapy and other causes are noncompliance, malabsorption and suboptimal drug metabolism and resistant organism.[78] in the above condition if the therapy is changed according to culture and sensitivity pattern or dosages and duration of treatment are adjusted then the infection resolves.

Bacterial persistence and re infection occur after urinary sterilisation. In case of persistence there is a nidus of infection in urinary tract into which antibiotic is not reaching and so same pathogen is cultured every time. Those protected sites of nidus are infected calculi, necrotic papillae and foreign bodies such as indwelling ureteral stent or urethral catheter which once infected cannot be sterilised.[79-83] Identification of this nidus is very important because surgical removal of these sites may be required to clear the infection.

E. coli occurs in many strains and so what seems to be E. coli persistence may actually be a re infection with different strain.[84]

In a one year longitudinal study[85] recurrent urinary tract infection occurred in 12% of children less than five years of age presenting to the emergency department with first urinary infection.

Recurrent urinary tract risk is more in 3 to 5 years age group, grade IV or V vesico ureteric reflux and in white race.[86]

Recurrent urinary tract infection often has an associated voiding disorder which is characterised by abnormal micturition in the presence of normal neuronal pathways and without congenital or anatomical abnormalities.[33, 87] voiding disorder produces abnormal bladder pressure and urinary stasis predisposing to urinary infection. The abnormality may be during the filling phase as in an overactive bladder or in evacuation phase as in dysfunctional voiding.[88] as constipation is associated with functional voiding disorder it is called bowel bladder dysfunction. Evaluation of these children includes two to three days observation of amount of fluid intake and frequency and volume of voided urine. Urinary stream and post void dribbling are also checked in boys. Urodynamic studies are rarely required. Bowel bladder dysfunction is treated with timely voiding, bladder re-training and clean intermittent catheterisation. In case of overactive bladder anti cholinergic drugs are effective.

Prophylaxis

Indications for prophylactic drugs in urinary tract infection are

- children less than one year awaiting imaging studies following an episode of urinary tract infection
- children with vesico ureteric reflux
- children with frequent febrile urinary infection that is occurrence of three or more episodes in an year

In case of grade I and II vesico ureteric reflux prophylaxis is given up to one year and restarted if febrile urinary tract infection occurs. In grade III to IV vesico ureteric reflux prophylaxis is given up to five years of age and surgery is done if breakthrough febrile urinary infection occurs. Beyond five years prophylaxis is continued only if there is bowel bladder dysfunction.

Prophylactic drug must be effective, non toxic with fewer side effects and should not affect the growth of commensals or induce bacterial resistance.[89]

Preferred antibiotics are

a. Cotrimoxazole 1-2 mg/kg/day (not in <3 months, G6PD deficiency)
b. Cephelexin 10mg/kg/day (preferred in 3-6months babies)

c. Cephadroxil 5mg/kg/day (alternative in early infancy)

d. Nitrofurantoin 1-2mg/kg/day (not in <3 months, G6PD deficiency, renal insufficiency)

In patients with recurrent urinary tract infection prophylactic antibiotics have been shown to be more effective than placebo in decreasing the number of recurrences.[91-94] No single antibiotic have been shown to be superior to others.[95, 96]

In a study by Patrick H Conway antimicrobial prophylaxis was not associated with lower risk of recurrent urinary tract infection but with increased risk of resistant infection.[86]

In a recent systematic review of patients with dilating reflux concluded that outcomes following surgical repair vs medical prophylaxis were similar in terms of number of break through infections and risk of renal scarring.[97] Two systematic reviews of randomized control trials between surgical and medical management of VUR found no difference in terms of recurrent urinary infection, renal scarring, hypertension and end stage renal disease.[100, 101]

Two randomised control trials involving grade III or IV vesico ureteric reflux and documented urinary tract infection surgery reduced the risk of

pyelonephritis but not UTI. Deflux procedures more effective than prophylaxis in preventing reflux but not urinary infection.[102]

Cranberry juice preventing urinary tract infection didn't get any supporting evidence.[103]

Break through urinary tract infection does not require change of prophylactic drug and there is no role for cyclic prophylactic therapy in which antibiotic is changed every six to eight weeks.

Complications and follow up

Renal scarring is found in 10-30% of children with urinary tract infection.[104,105] Orellana and colleagues found a significant higher incidence of renal scarring in children with non E. coli infection.[106]

Smellie and colleagues found renal damage to occur more commonly in infants and children suggesting younger kidneys are more susceptible to scarring.[111]

Long term studies have now established a causal relationship between paediatric urinary tract infection and renal scarring and subsequent development of hypertension.[111, 107,108] Proposed mechanism is renin angiotensin system and atrial natriuretic peptide.

End stage renal disease with paediatric urinary infection is rare.[109, 110]

Wennerstrom and colleagues showed that GFR significantly reduced in scarred kidneys during twenty years follow up period.[110]

Patients with reflux nephropathy have to be followed up regularly for growth monitoring, blood pressure monitoring every six to twelve months through adolescence. Annual USG has to be done to look for renal growth. Proteinuria and serum creatinine have to be assessed during every visit.

Asymptomatic bacteriuria

Significant bacteriuria in the absence of symptoms of urinary infection is called asymptomatic bacteriuria. Significant bacteriuria is colony count of $>10^5$/ml of single species in midstream clean catch urine sample's culture.[36] It occurs in 1-2% of girls and 0.2% of boys.[2] It is a benign condition and the usual organism identified is E. coli with low virulence. Eradication of this organism leads to symptomatic urinary tract infection with more virulent strains and hence therapy or prophylaxis is not needed.[2]

Wettergren and colleagues followed thirty seven children with asymptomatic bacteriuria for six years and there was no evidence of decreased renal function.[112]

Aims and objectives

1. To analyse the clinical and demographic profile of urine culture positive urinary tract infection patients aged 2 – 12 years coming to our hospital which is a tertiary care centre catering to low socio economic status children.

2. To analyse the risk factors associated with urinary tract infection in 2 – 12 years age group.

Materials and methods

Type of study

Profile - Prospective descriptive

Risk factor analysis – case control study

Place of study

Tertiary care centre

Period of study

July 2011 to August 2012

Inclusion criteria

1. Signs and symptoms suggestive of urinary tract infection

2. Urine culture positivity

Exclusion criteria

Age <2 years and >12 years

Definition of cases and controls taken in risk factor analysis

Cases

- ✓ Children with any symptom or sign suggestive of urinary tract infection
- ✓ Children aged between two to twelve years
- ✓ Urine culture with significant growth

Controls

Age and sex matched children who are free of

- ✓ Any acute febrile illness
- ✓ Urinary symptoms
- ✓ Abdominal pain
- ✓ Vomiting

Methodology

Study design was made out and then Ethical committee approval was obtained.

Children with symptoms and signs suggestive of urinary tract infection in 2-12 years age group were chosen. Informed written consent is taken from child's parent or guardian. Child's history is then recorded as answers to pre prepared questionnaire in a profoma and clinical examination was done and findings recorded. Risk factors for urinary tract infection are also asked with a questionnaire in the profoma. Then the parent or guardian is explained about how to collect a clean catch midstream urine sample and its importance. For boys it is advised to wash genitalia with water then retract the prepuce gently and collect the midstream sample. For girls it is advised to wash genitalia with water then separate both labia and collect the midstream sample. The collected sample is immediately sent to microbiology laboratory and plating done within one hour.

Urine is also collected for bedside analysis for proteinuria and microscopy to look for deposits. Proteinuria is checked by doing a heat coagulation test. Three fourth of the test tube is filled with urine and

upper part of the tube is heated in the flame. The urine turns cloudy if there is protein or phosphate in it. Next dilute acetic acid is added to the test tube to look for dissolution of cloudiness. If it dissolves it is due to the presence of phosphates if it doesn't get dissolved it is due to the presence of protein.

Interpretations of amount of cloudiness are

- ✓ Trace - Faint cloudiness
- ✓ + - definite non granular cloud
- ✓ ++ - heavy granular cloud
- ✓ +++ - Dense cloud with flocculation
- ✓ ++++ - Thick cloudy flocculation with coagulation

For microscopy five ml of urine is taken in a test tube and centrifuged after placing another test tube with five ml water at the opposite end at 2000-3000 rotations per minute. Then the deposit is looked under microscope for pus cells, red blood cells or white blood cell casts.

Blood sampling is done for all patients and sent to laboratory to measure haemoglobin, urea, creatinine and a total and differential count. If the child is an outpatient then the patient is advised to review after two days awaiting urine culture and sensitivity reports. Febrile toxic children and

children with vomiting are admitted as inpatient and treatment initiated as per hospital protocols.

If the urine culture turns out to be negative the patient is excluded from the study.

If urine culture is positive then the organism and sensitivity pattern is recorded. Repeat urine culture was done if there is mixed growth. Then the patient is proceeded with imaging studies.

All patients underwent ultra sonogram of the abdomen and the finding is recorded.

Voiding cysto urethrogram is done two weeks after treatment completion for children aged between two to five years and also for children with abnormality in kidney, ureter, bladder and urethra. It is also done for patients with recurrent urinary tract infection. Findings are recorded.

If the patient is inpatient duration of hospital stay is recorded.

For risk factor analysis age and sex matched control children fulfilling the definition are taken and the same risk factor questionnaire is asked to them.

The observations are then analysed. Risk factor analysis is done by binary logistic regression analysis.

Observations and results

Age in years

Among the 214 cases analysed in the study 64 children belonged to 2-5years of age constituting 29.9% and 150 children belonged to 5 – 12 years of age constituting 70.1%.

TABLE 4 - AGE

AGE	n	%
2-5yrs	64	29.9%
5-12yrs	150	70.1%
Total	214	100%

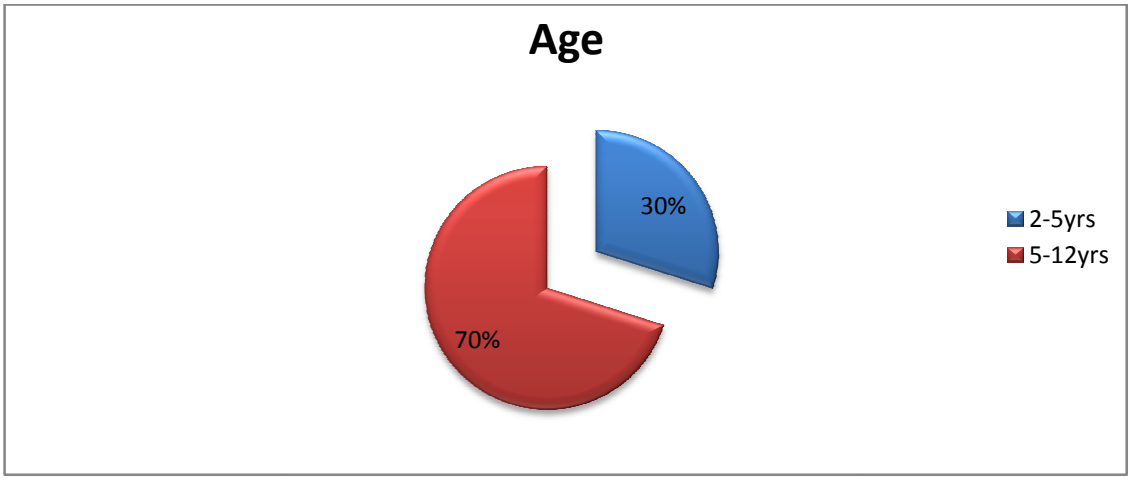


CHART 1 - AGE

Sex distribution

In the total of 214 children 128 were male and 86 were female constituting 59.8% and 40.2% respectively.

TABLE 5 – SEX

SEX	n	%
Male	128	59.8%
Female	86	40.2%
Total	214	100%

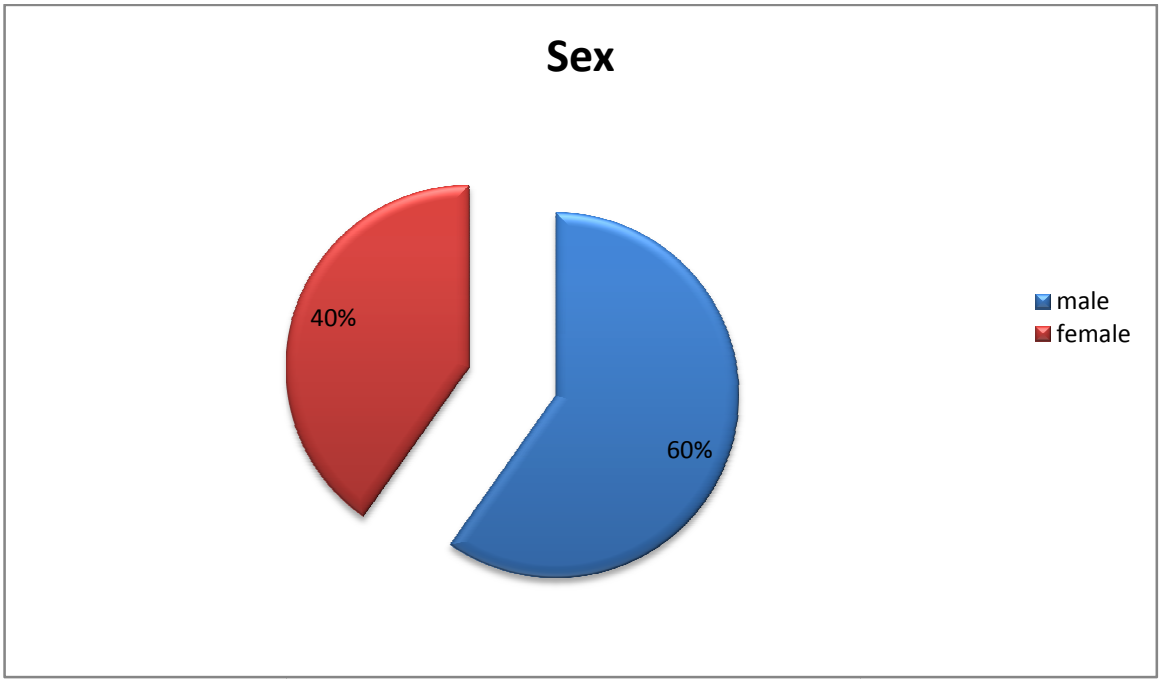


CHART 2 – SEX

Socio economic class

76 patients belonged to class V according to modified kuppusamy classification of socio economic class constituting 35.5% and 118 patients belonged to class IV constituting 55.1% and 20 patients belonged to class III constituting 9.3%. No patient was in class II or I.

TABLE 6 – S0CIO ECONOMIC CLASS

S E C	n	%
Class V	76	35.5%
Class IV	118	9.3%
Class III	20	55.1%
Total	214	100%

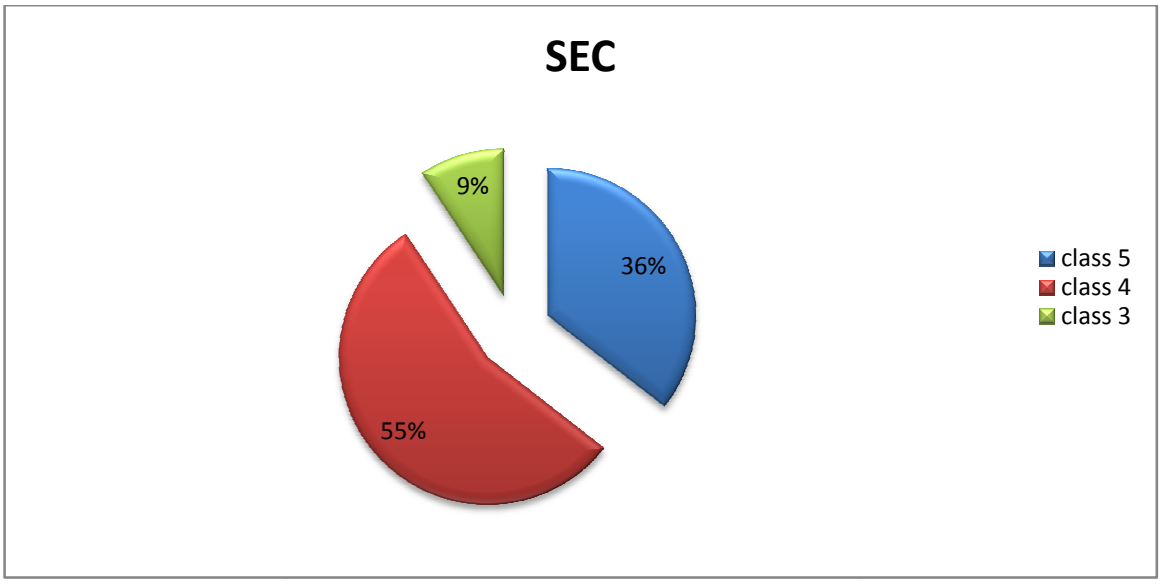


CHART 3 – SOCIO ECONOMIC CLASS

Locality

193 patients were from urban area and 21 patients from rural area constituting 90.2% and 9.8% respectively.

TABLE 7 - LOCALITY

LOCALITY	n	%
Urban	193	90.2%
Rural	21	9.8%
Total	214	100%

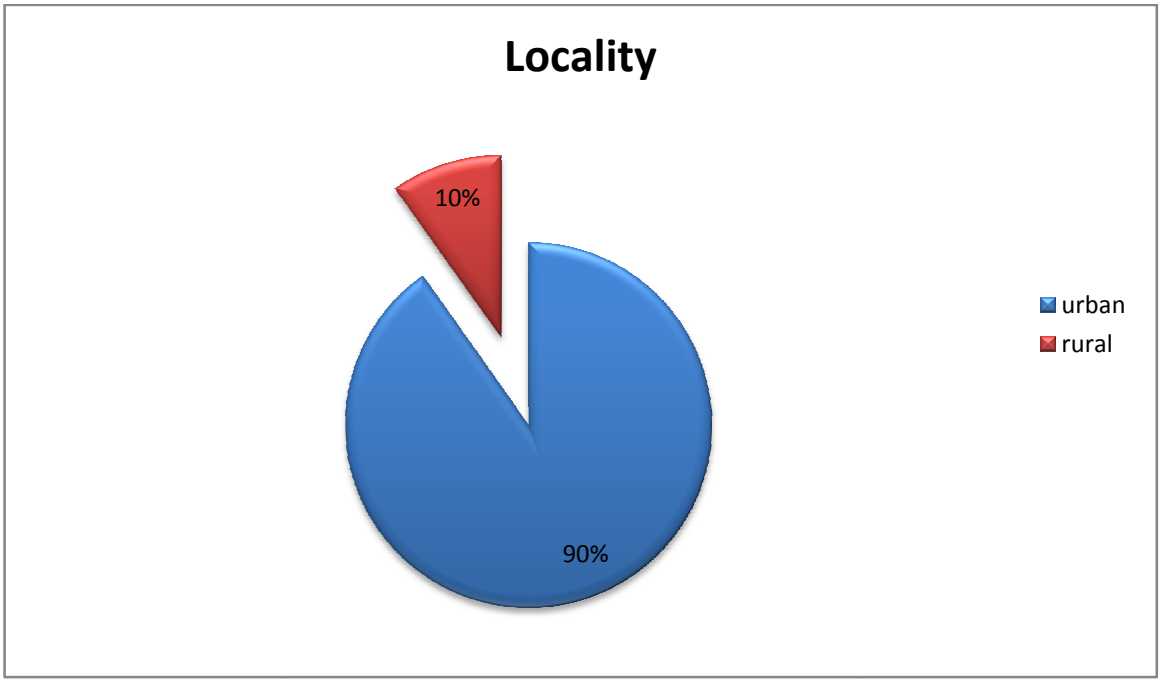


CHART 4 - LOCALITY

Risk factors

Parents and patients were questioned regarding history suggestive of twelve risk factors. Among 128 boys included in the analysis 111 boys were not circumcised constituting 86.7%.

Recent hospitalisation was asked as any hospitalisation within one month before the beginning of present symptoms. 20 children gave history of recent hospitalisation. Among them two children were admitted for urinary infection. It was around 9.3% of total.

Recent catheterisation history was there in one child and it constitutes only 0.5% of the total.

Number of children using common toilet was 42 which constituted 19.6% of study population.

Cleaning habit after toilet usage in girls was asked. Wiping back to front history was there in 15 girls among total 86 constituting 17.4% of the total.

Constipation history was asked and was present in 39 children which was around 18.2%.

Usage of tight underclothing was there in 2 children which constituted 0.9%.

Diaper usage during routine day today life was there in 17 children and it was around 7.9% of the total.

Worm infestation history was asked by visualization of the worm or night time scratching around anal orifice and it was there in 56 patients which comes to around 26.2% of study population.

Neurological abnormality like hemiplegia, paraplegia, cerebral palsy, mental retardation was there in 8 patients which constituted to around 3.7%.

Voluntary withholding of urine mainly in school hours was present in 72 children which constituted 33.6%.

Reduced water intake mainly during school hours was there in 74 children which is around 34.6% of the total.

TABLE 8 – RISK FACTORS

RISK FACTOR	**n**	**%**
Not circumcised (male)	111	86.7%
Recent hospitalisation	20	9.3%
Recent catheterisation	1	0.5%
Common toilet	42	19.6%
Cleaning back to front (female)	15	17.4%
Constipation	38	18.2%
Tight underclothing	2	0.9%
Diaper usage	17	7.9%
Worm infestation	56	26.2%
Neurological abnormality	8	3.7%
Voluntary withholding of urine	72	33.6%
Reduced water intake	74	34.6%

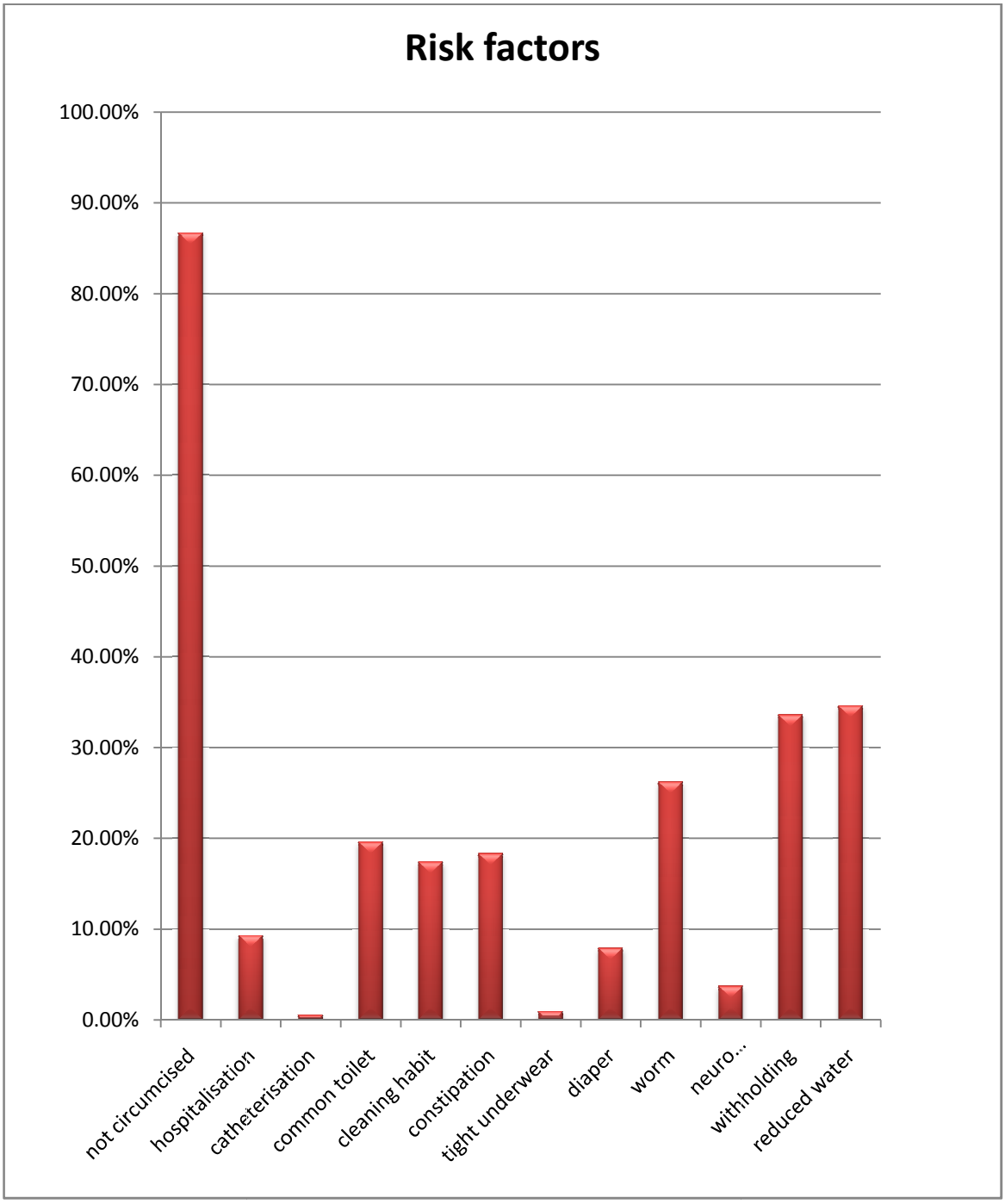


CHART 5 – RISK FACTORS

Symptoms

Among 214 children 160 had fever history. 47 children had <3 days fever which is around 22% of total children and 3 to 5 days history was in 40 children constituting 18.7% and fever was present for >5 days in 73 children constituting 34.1%. Total fever cases summed up to 64.8% and fever was the most common symptom observed in the study.

Chills and rigor was present in 82 patients with fever and 4 patients without fever with a total of around 40.2%.

Burning micturition history was present in 86 children which is around 40.2%. Children who couldn't say exactly about burning sensation complained about pain or irritation or cry during micturition.

Increased frequency of micturition with small voids every time was present in 111 children constituting 51.9%. This symptom is observed the most common next only to fever in the study population.

High coloured urine history was present in 9 patients. 2 patients complained of passing blood in urine, 6 patients told of red coloured urine and one patient complained orange coloured urine. This constitutes around 4.2%.

Cloudy urine was noticed by parent in 4 patients constituting 1.9%. They told of cloudiness and sedimentation of passed urine.

Abdominal pain was present in 98 patients constituting 45.8%. This is the next common history to increased frequency noticed in the study group.

Vomiting was present in 47 patients which is around 22% of the total.

History of preputial bulging while urinating was present in 17 boys out of 128 boys which is around 13.2%.

Enuresis as a symptom was asked only for children more than five years of age and was present in 13 children out of 150 children constituting around 8.7%.

TABLE 9 - SYMPTOMS

SYMPTOMS	**n**	**%**
Fever		
<3 days	47	22%
3-5 days	40	18.7%
>5 days	73	34.1%
Chills and rigor	86	40.2%
Burning micturition	86	40.2%
Increased frequency	111	51.9%
High coloured urine	9	4.2%
Cloudy urine	4	1.9%
Abdominal pain	98	45.8%
Vomiting	47	22%
Preputial bulging (males)	17	13.2%
Enuresis (>5yrs)	13	8.7%

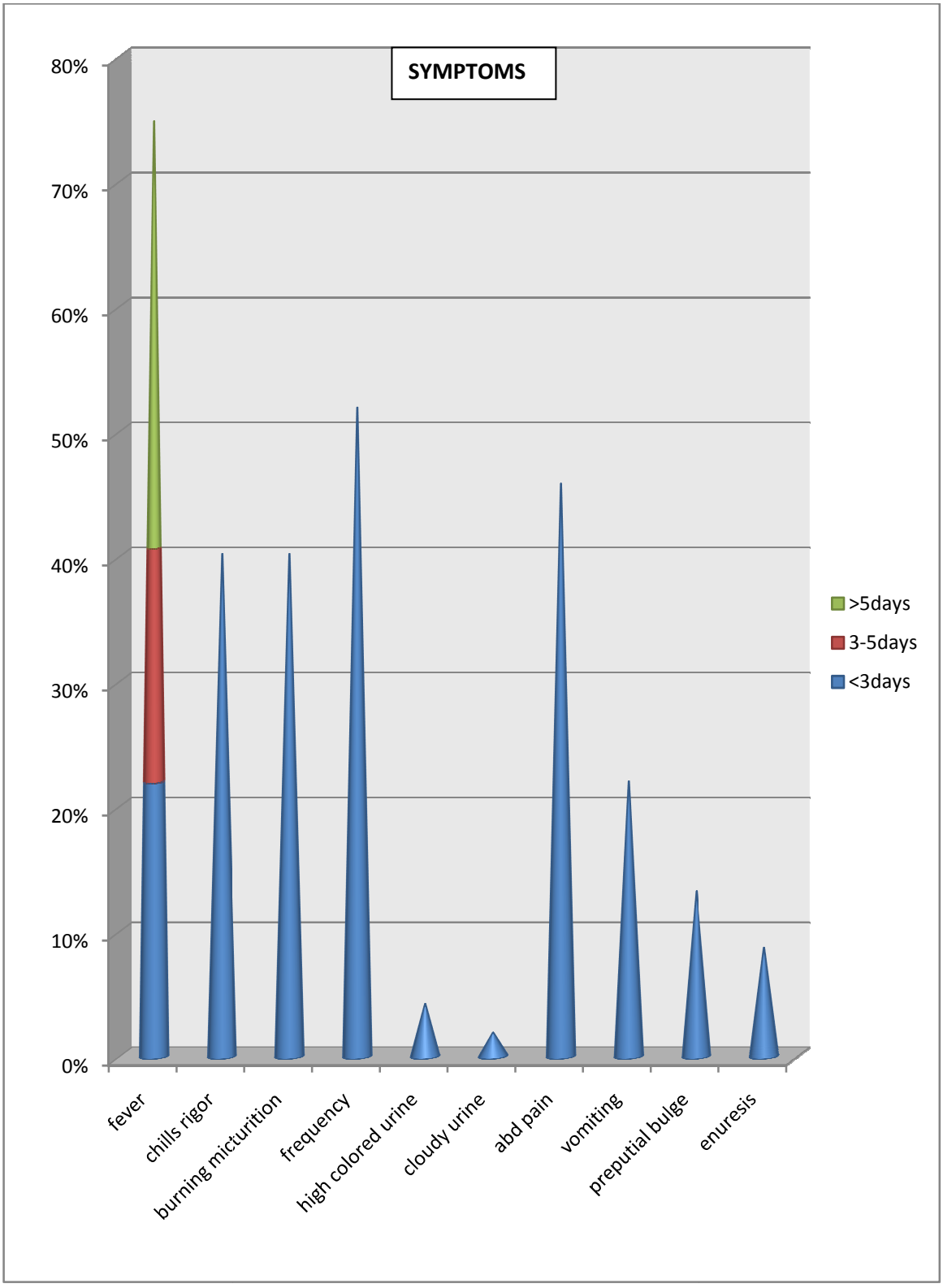


CHART 6 - SYMPTOMS

Previous urinary tract infection

History of previous urinary infection was present in 15 patients which was 7% of total. Among these 15 children 13 had previous one episode of UTI and two had more than two episodes.

TABLE10 – PREVIOUS UTI

EPISODES	n	%
One	13	6.1%
More than one	2	0.9%

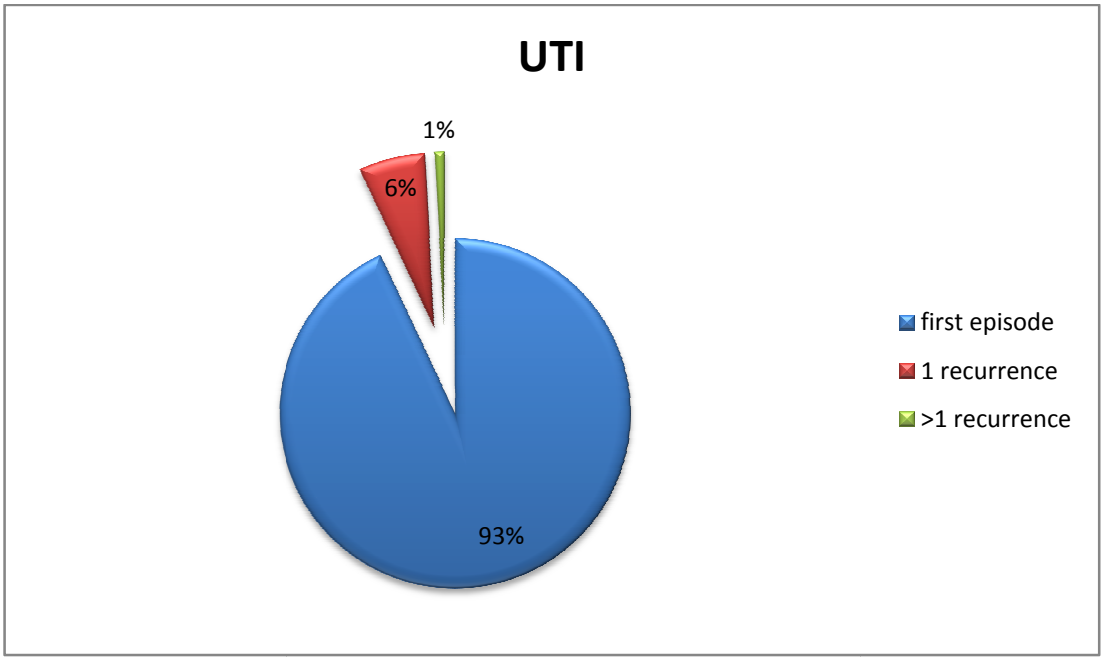


CHART 7 – PREVIOUS UTI

Clinical examination

Growth retardation was assessed by measuring height for age and anything <80% is considered dwarf (severe retardation in growth) according to McLaren's classification. Growth was severely affected in 4 children constituting 1.9%.

Phimosis was present in 17 boys out of 128 boys which is around 13.3%.

Vaginal synechiae was not noticed in any child in study group.

External urogenital malformation was also not present in any child.

Edema in the form of facial puffiness which reduces as day progresses was present in 13 children which was around 6.1%.

Renal angle tenderness was present in 2 children and it constitutes 0.9% of the total.

Supra pubic tenderness was present in 84 children which was around 39.3%.

Hypertension was present in 1 child constituting 0.5%.

TABLE 11 – CLINICAL FINDING

FINDING	**n**	**%**
Growth retardation	4	1.9%
Phimosis (male)	17	13.3%
Vaginal synechiae	0	0%
Malformations	0	0%
Facial edema	13	6.1%
Renal angle tenderness	2	0.9%
Supra pubic tenderness	84	39.3%
Hypertension	1	0.5%

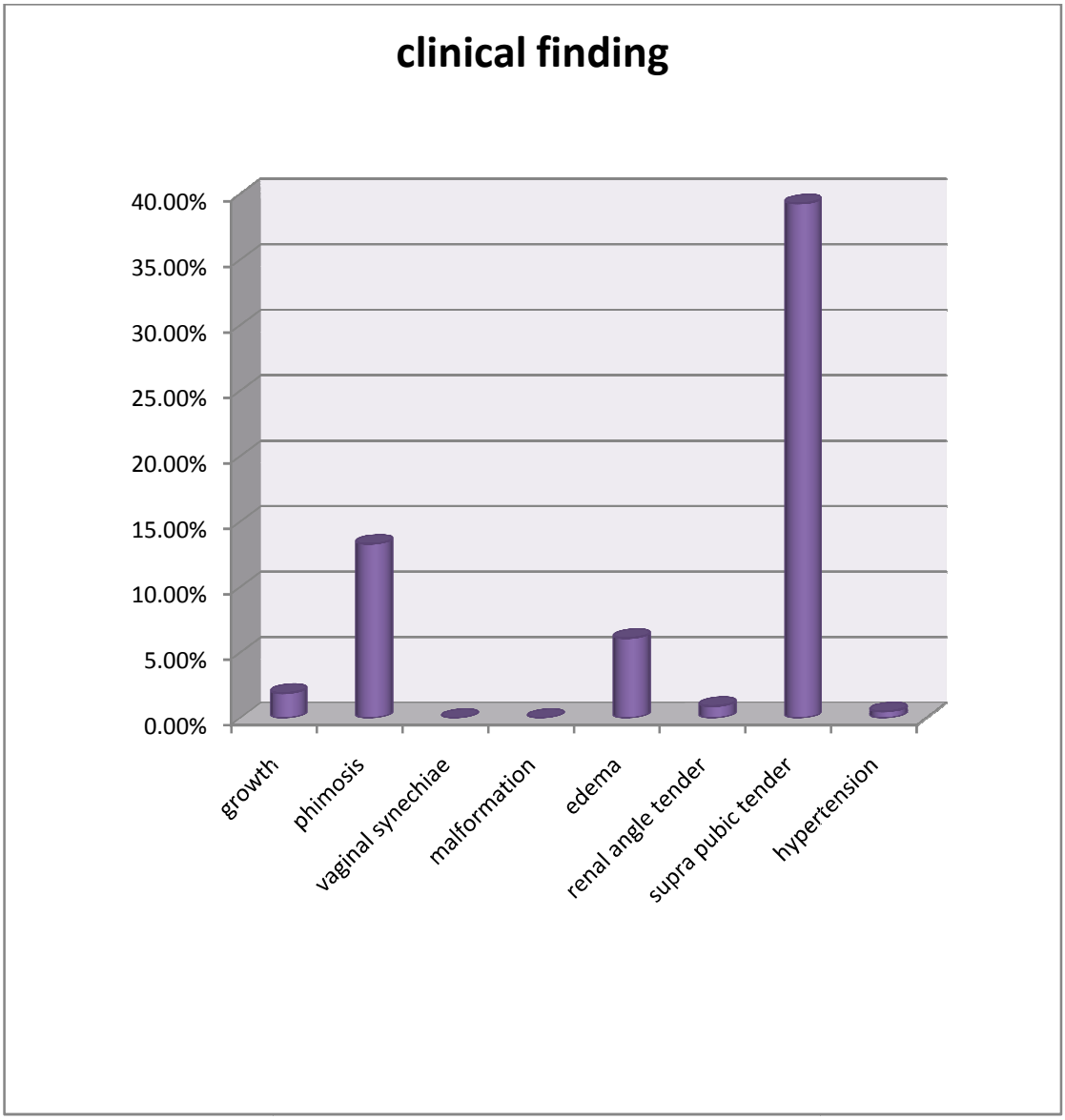


CHART 8 – CLINICAL FINDING

Bed side investigations

Proteinuria was observed in 68 children. 22 children had trace proteinuria and 46 children had (+) proteinuria. Totally it was present in 31.8% of children.

Significant pus cells of >5/hpf was present in 77 patients constituting 36%.

Hematuria was present in 34 patients which was around 15.9% of the total.

TABLE 13 – BED SIDE TESTS

BED SIDE TEST	n	%
Proteinuria	68	31.8%
Pyuria	77	36%
Hematuria	34	15.9%

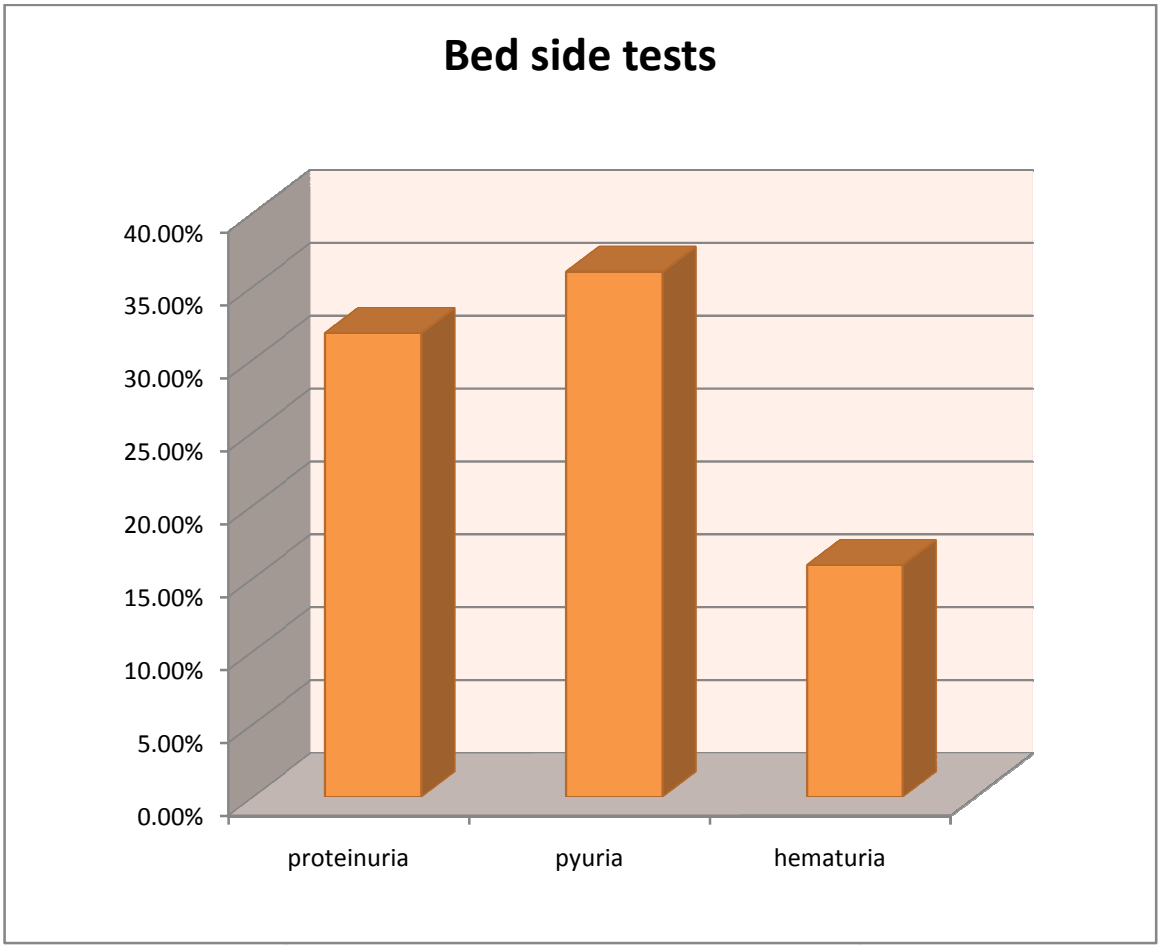


CHART 9 – BED SIDE TESTS

Laboratory investigations

Anaemia was present in 65 children constituting 30.4%.

Erythrocyte sedimentation rate was raised in 39 patients which was around 18.2% of the total.

WBC count was increased in 82 patients which was around 38.3%.

Leukopenia was present in 1 patient which was around 0.5%.

Mantoux was positive in 2 patients, 0.9% of total.

Urea and creatinine were normal in all children.

TABLE 14 - INVESTIGATIONS

INVESTIGATION REPORTS	n	%
Anaemia	65	30.4%
Increased ESR	39	18.2%
Leukocytosis	82	38.3%
Leukopenia	1	0.5%
Mantoux positivity	2	0.9%
Elevated urea	0	0%
Elevated creatinine	0	0%

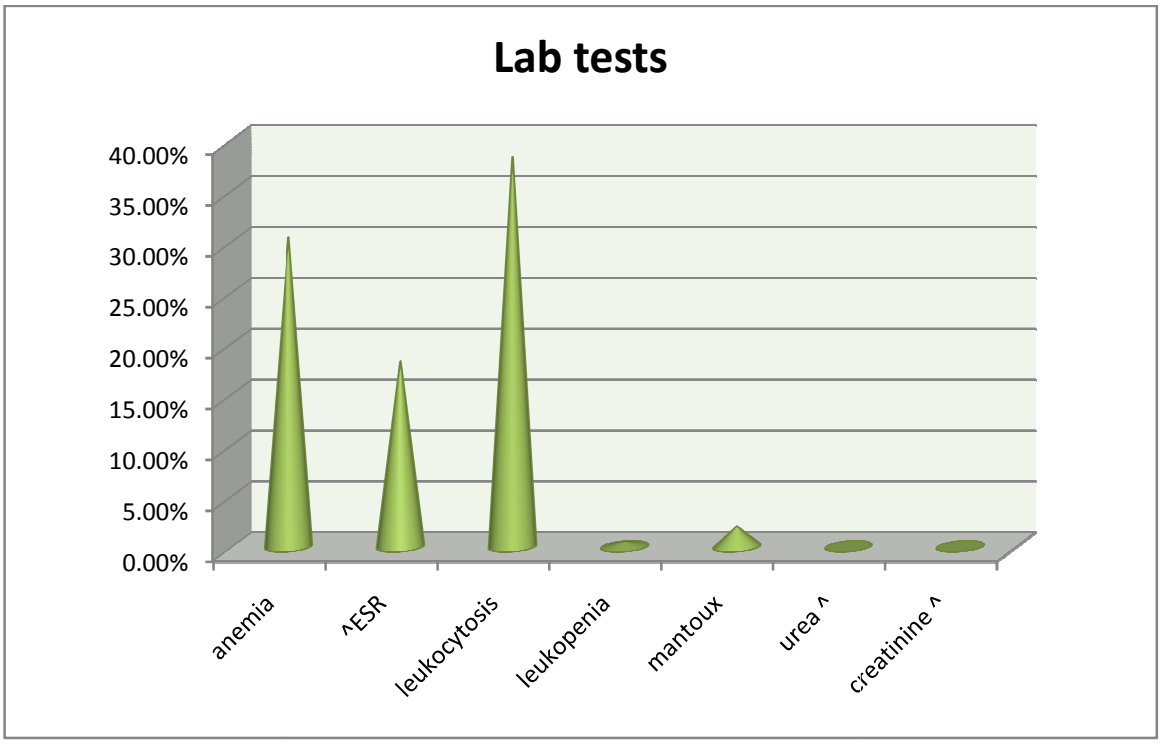


CHART 10 – LAB TESTS

Etiology

E. coli was grown in the urine culture of 98 children which was 45.8% of the total. This was the most common causative organism in the study group.

This was followed by Klebsiella spp. in 51 children which is around 23.8%.

21 children's urine culture grew Proteus mirabilis which is around 9.8% of the total.

Coagulase negative staphylococcus was grown in 9 children which constitutes 10.1%

Staphylococcus aureus was grown in 4 children which is 1.9% of the total.

Enterococcus was grown in 17 children and Citrobacter in 1 child and this constitutes 7.9% and 0.5% respectively.

TABLE 15 - ETIOLOGY

ORGANISM	n	%
E. coli	98	45.8%
Klebsiella	51	23.8%
Proteus	21	9.8%
Pseudomonas	13	10.1%
CONS	9	4.2%
Staphylococcus aureus	4	1.9%
Enterococcus	17	7.9%
Citrobacter	1	0.5%

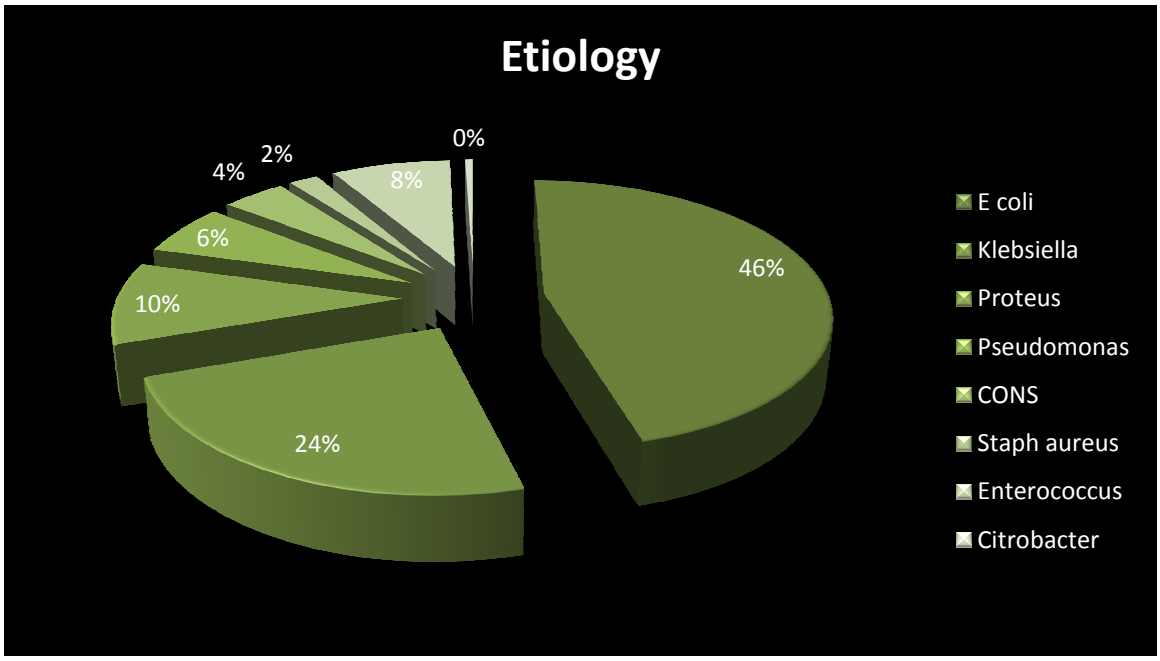


CHART 11 - ETIOLOGY

Antibiotic sensitivity pattern

E. coli

100% of organisms were sensitive to amikacin, 48.9% to erythromycin, 2% to ampicillin, 75.5% to cefotaxime, 61.2% to ciprofloxacin, 57.1% to norfloxacin, 55.1% to cotrimoxazole, 40.8% to cephelexin, 28.5% to amoxicillin and 73.4% to gentamycin.

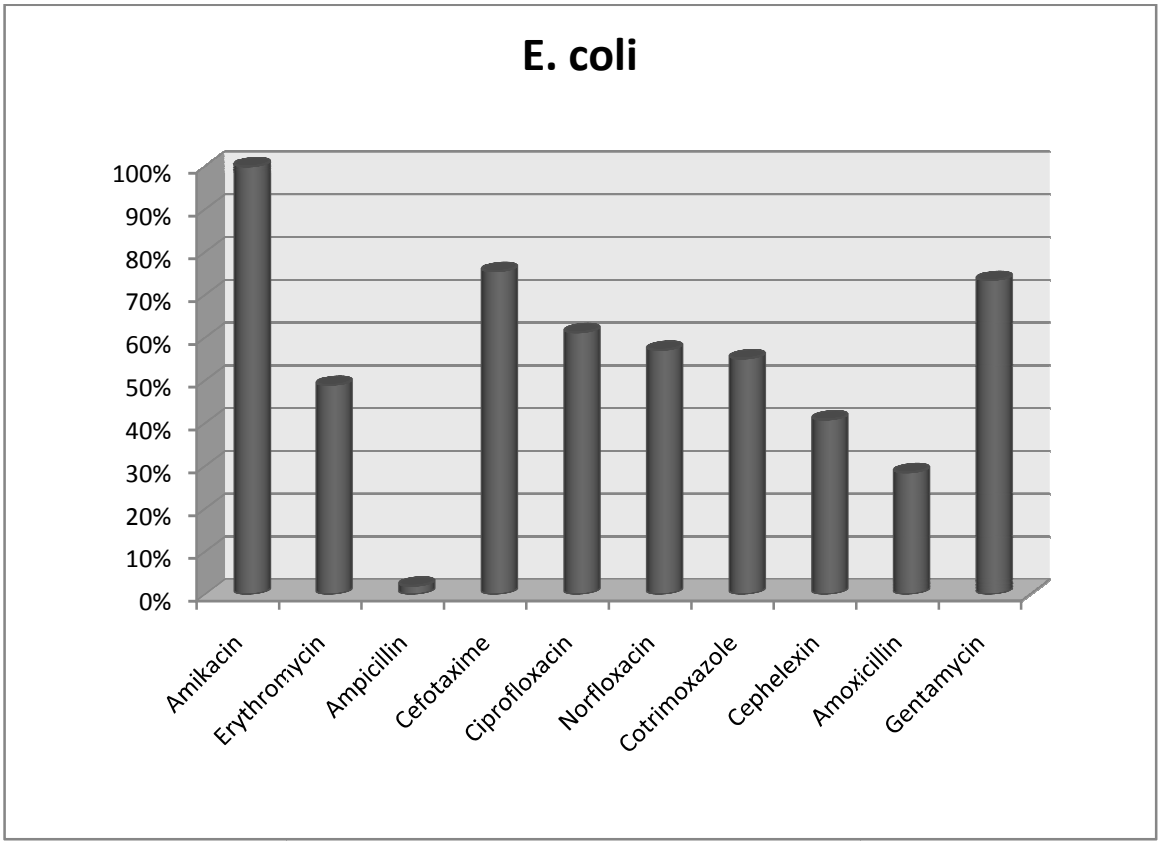


CHART 12 – SENSITIVITY PATTERN OF E. COLI

Klebsiella spp.

100% of organisms were sensitive to amikacin, 60% to erythromycin, 12% to ampicillin, 84% to cefotaxime, 40% to ciprofloxacin, 42% sensitive to norfloxacin, 64% sensitive to cotrimoxazole, 40% to cephelexin, 16% to amoxicillin and 72% to gentamycin.

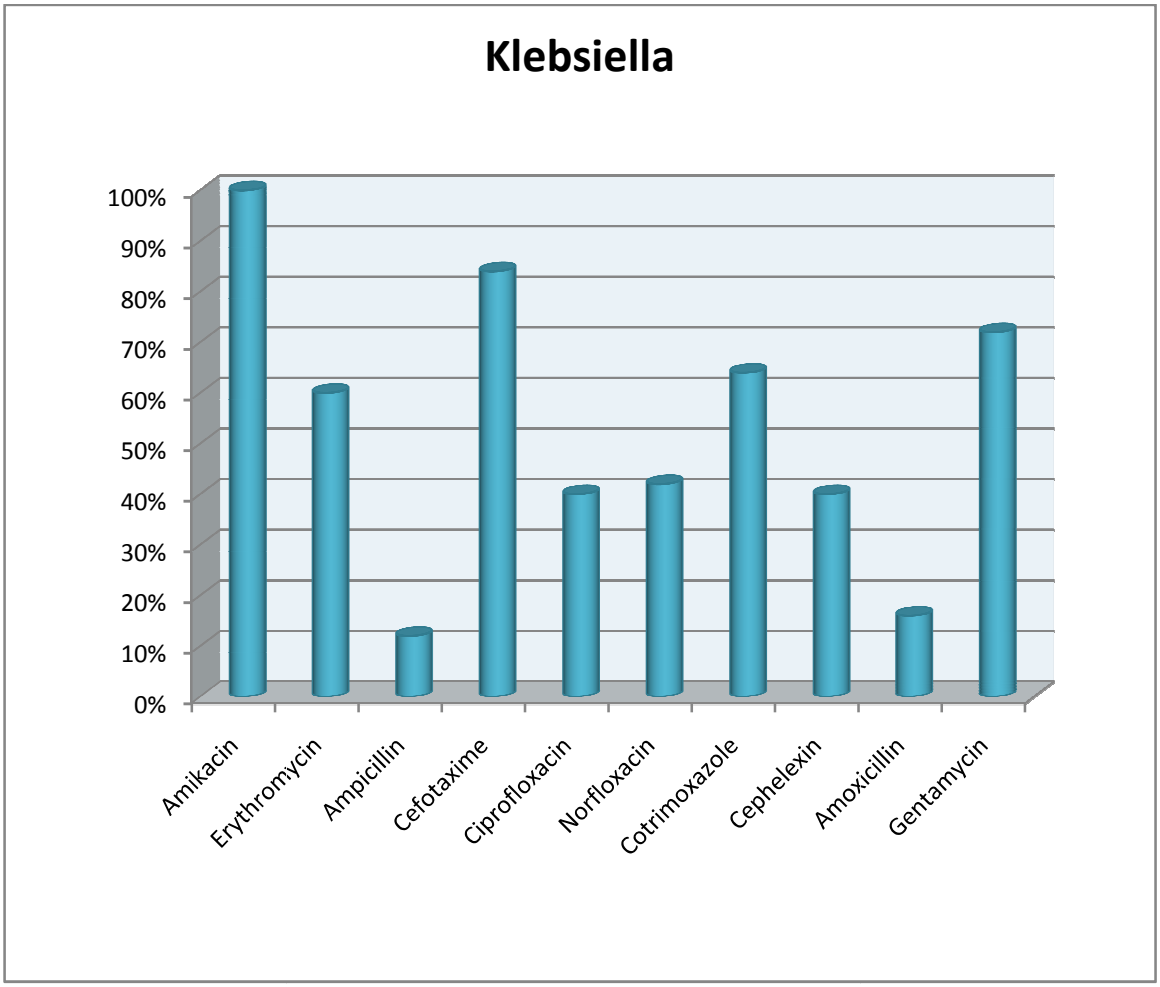


CHART 13 – SENSITIVITY PATTERN OF KLEBSIELLA

Proteus

100% of organisms were sensitive to amikacin, 66.6% were sensitive to erythromycin, 61.9% to ampicillin, 76.1% to cefotaxime, 14.2% to ciprofloxacin, 28.5% to norfloxacin, 19% were sensitive to cotrimoxazole and 85.7% to gentamycin.

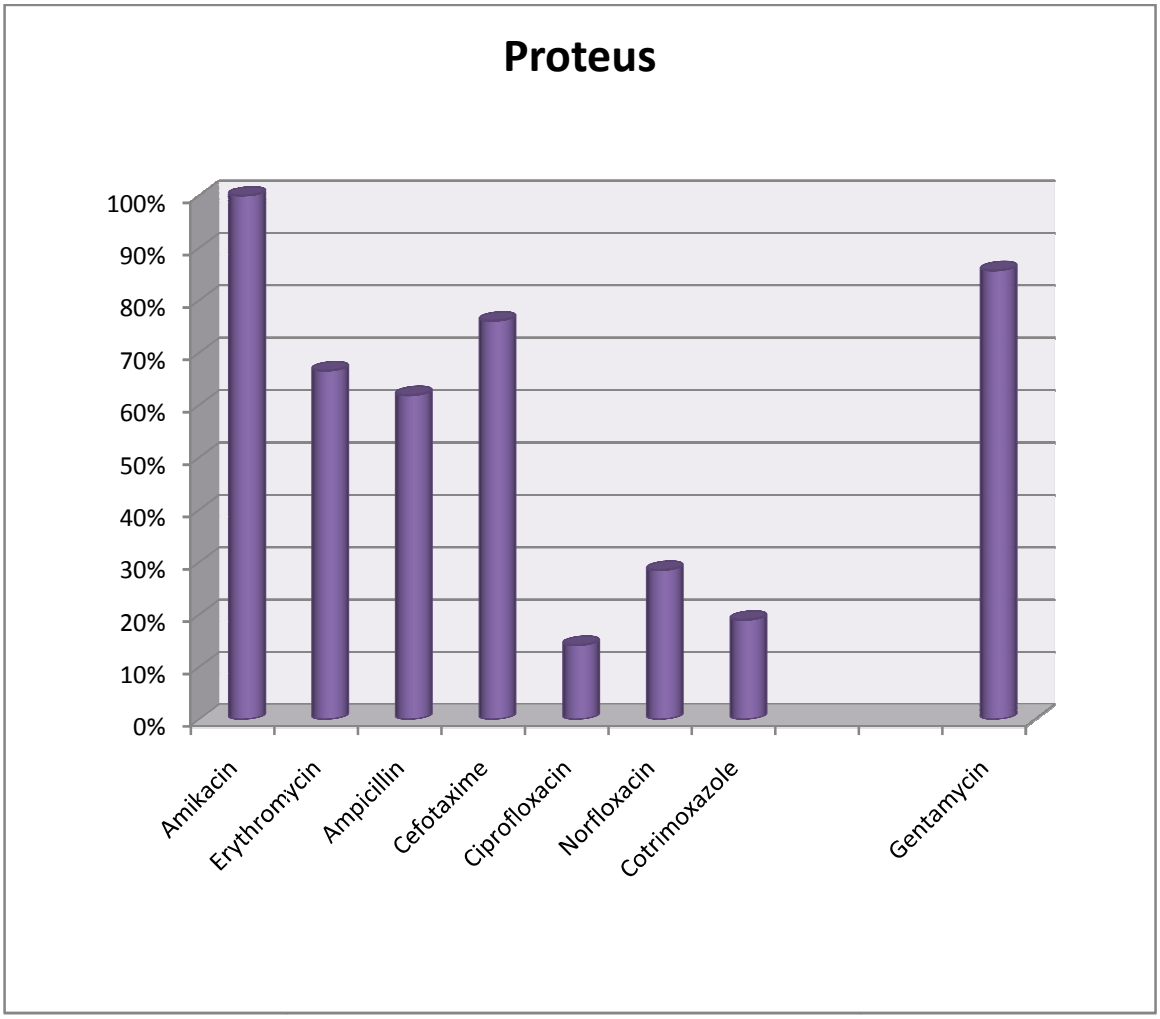


CHART 14 – SENSITIVITY PATTERN OF PROTEUS

Pseudomonas

100% of organisms were sensitive to amikacin, 38.4% to ampicillin, 61.5% to cefotaxime, 69.2% to ciprofloxacin, 46.1% to norfloxacin, 15.3% were sensitive to cotrimoxazole and 61.5% to gentamycin.

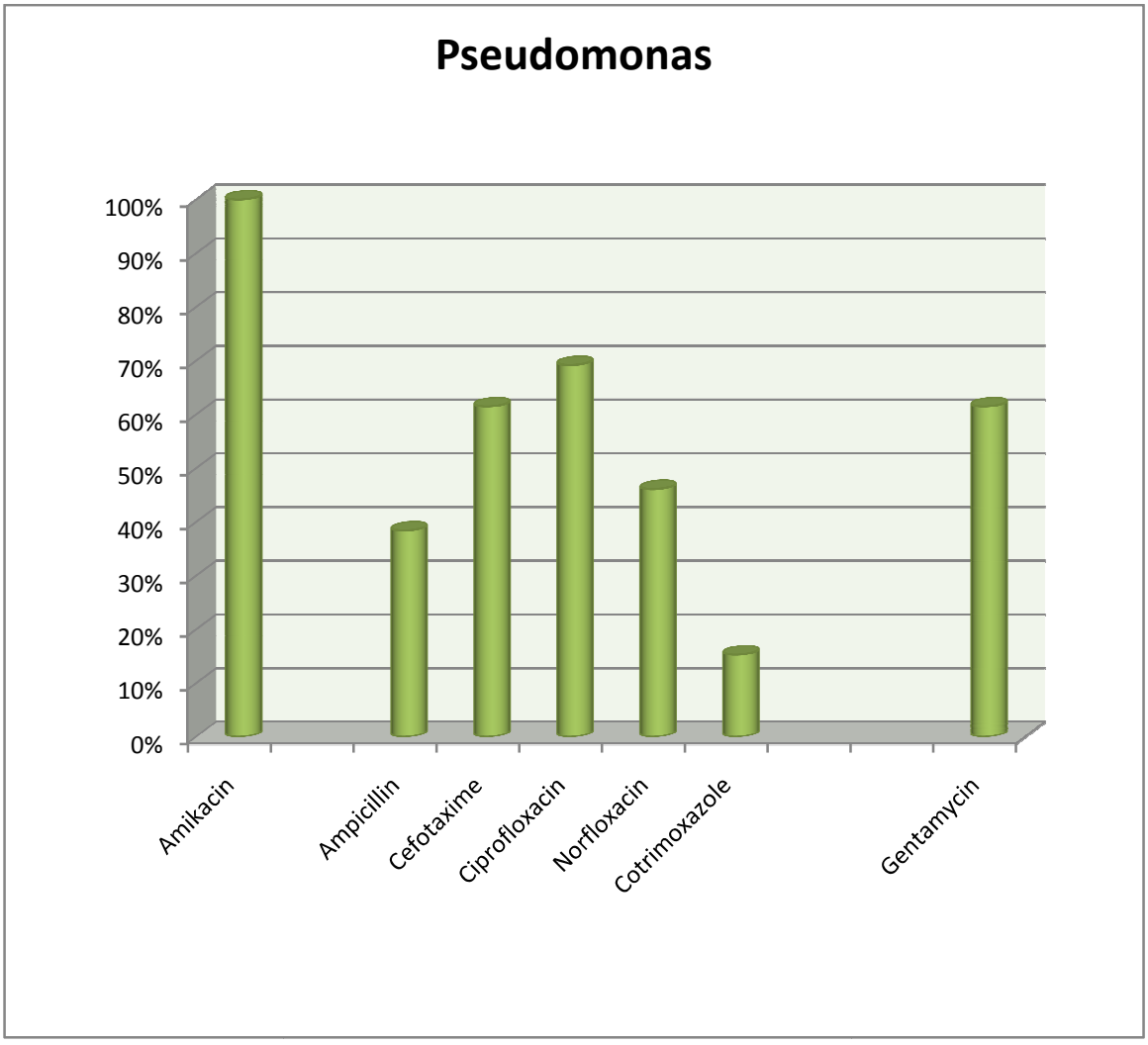


CHART 15 - PSEUDOMONAS

Coagulase negative Staphylococcus aureus

100% of organisms were sensitive to amikacin, 55.5% were sensitive to erythromycin, 66.6% to ampicillin, 33.3% to ciprofloxacin, 11.1% were sensitive to cotrimoxazole, 44.4% to cephelexin, 33.3% to amoxicillin, 100% to vancomycin and 11.1% to gentamycin.

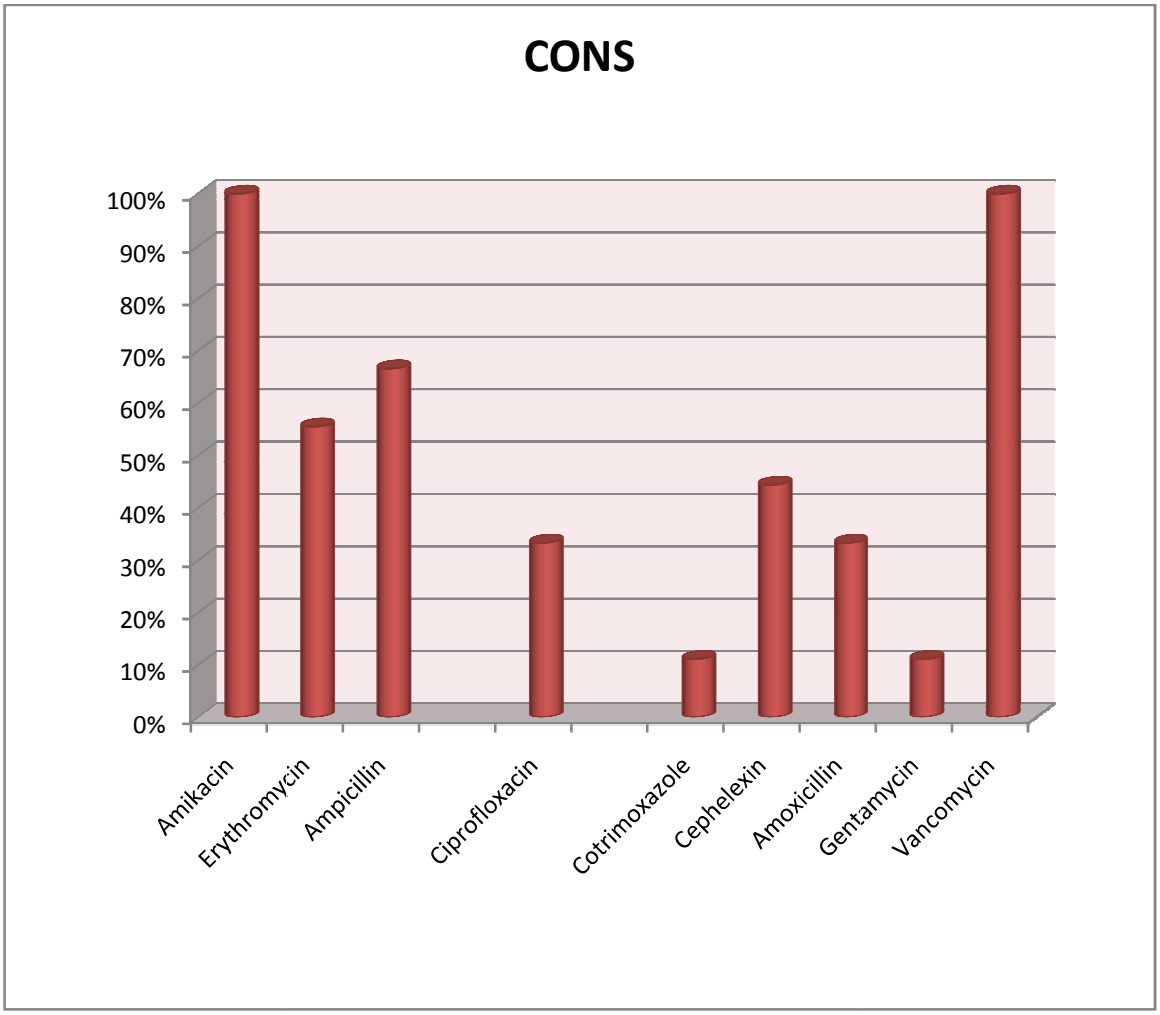


CHART 16 – COAGULASE NEGATIVE STAPHYLOCOCCUS AUREUS

Staphylococcus aureus

100% of organisms were sensitive to amikacin, 50% were sensitive to erythromycin, 50% to ampicillin, 25% to ciprofloxacin, 25% were sensitive to cotrimoxazole, 75% to cephelexin, 25% to amoxicillin, 100% to vancomycin and 25% to gentamycin.

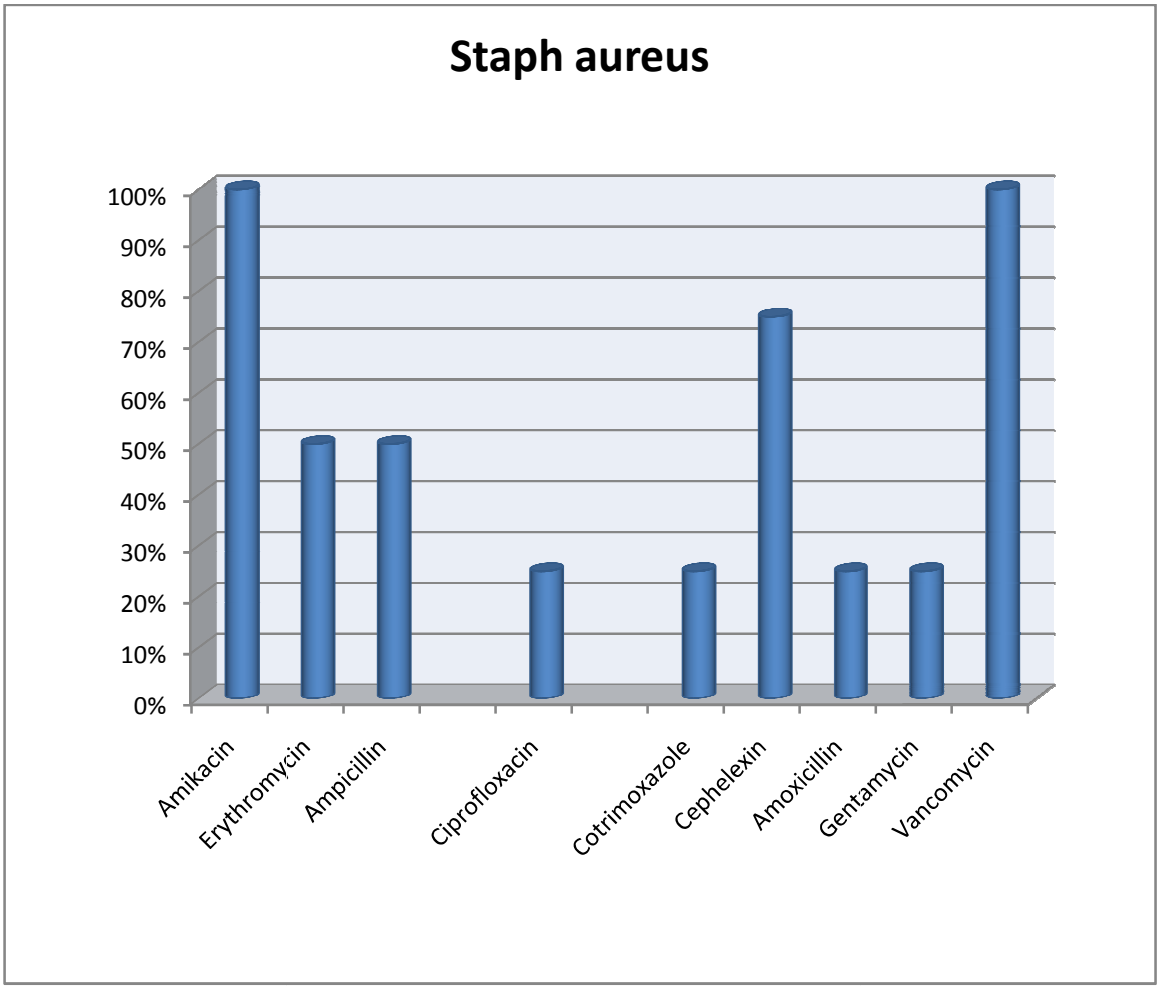


CHART 17 – STAPHYLOCOCCUS AUREUS

Enterococcus

23.5% were sensitive to erythromycin, 5.8% to ampicillin, 47% to cefotaxime, 23.5% to ciprofloxacin, 11.7% were sensitive to cotrimoxazole,23.5% to cephelexin, 5.8% to amoxicillin, 29.4% to vancomycin and 70.5% to gentamycin.

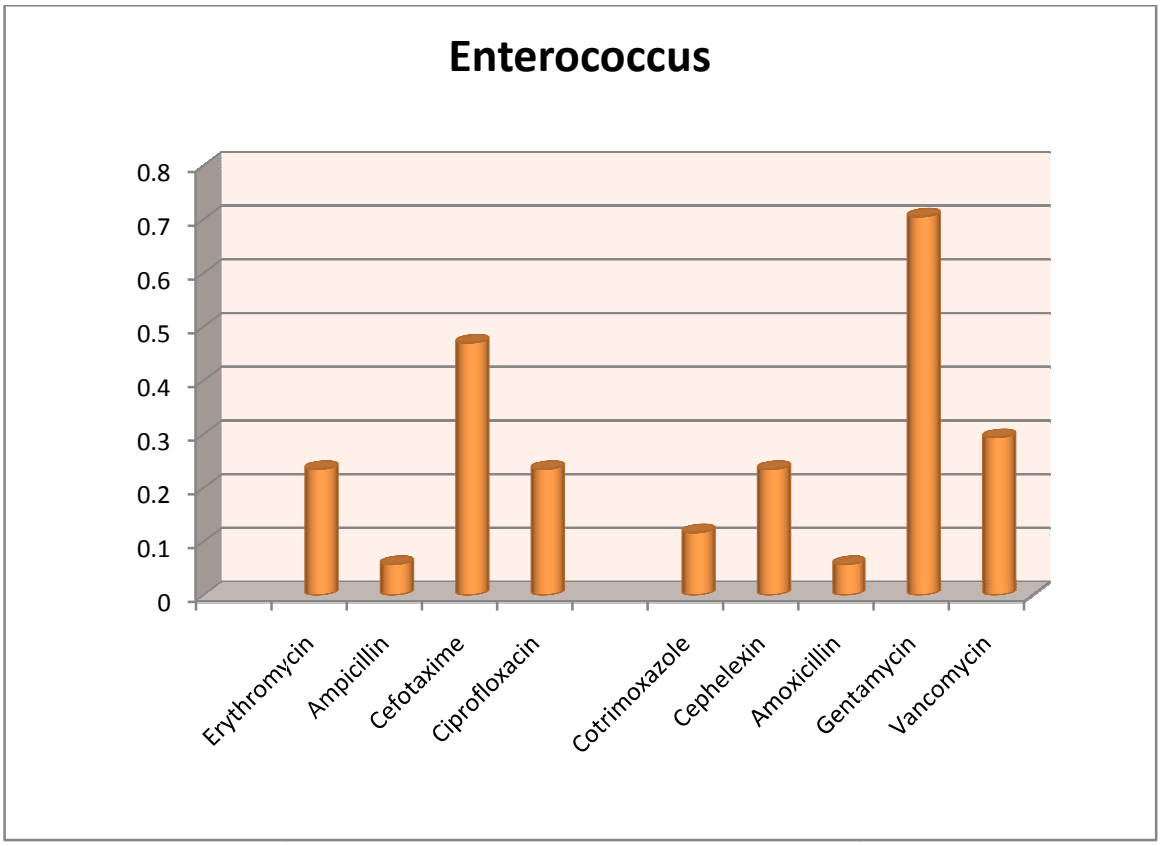


CHART 18 - ENTEROCOCCUS

Citrobacter

Only one child had citrobacter grown in culture and it was sensitive to amikacin, erythromycin, cefotaxime and gentamycin.

Imaging studies

Ultra sound abdomen was done for all patients in the study. 42 children had cystitis, 42 had splenomegaly, 5 had hydronephrosis and rest of the 125 had normal study. This constitutes 19.6%, 19.6%, 2.3% and 58.4% respectively.

A voiding cysto urethrogram was done for all children 2 to 5 years and also for two children >5 years as they had hydronephrosis in their USG. So a total of 66 children underwent VCUG and it was normal in 62 (94%) children including one child with hydronephrosis. VCUG showed reflux into the dilated ureters in 3 children and reflux into bilateral double ureters in 1 child. So VCUG was abnormal in 4 children (6%).

Ultrasound abdomen

TABLE 16 - USG

U S G	n	%
Cystitis	42	19.6%
Splenomegaly	42	19.6%
Hydroureteronephrosis	5	2.3%
Normal	125	58.4%

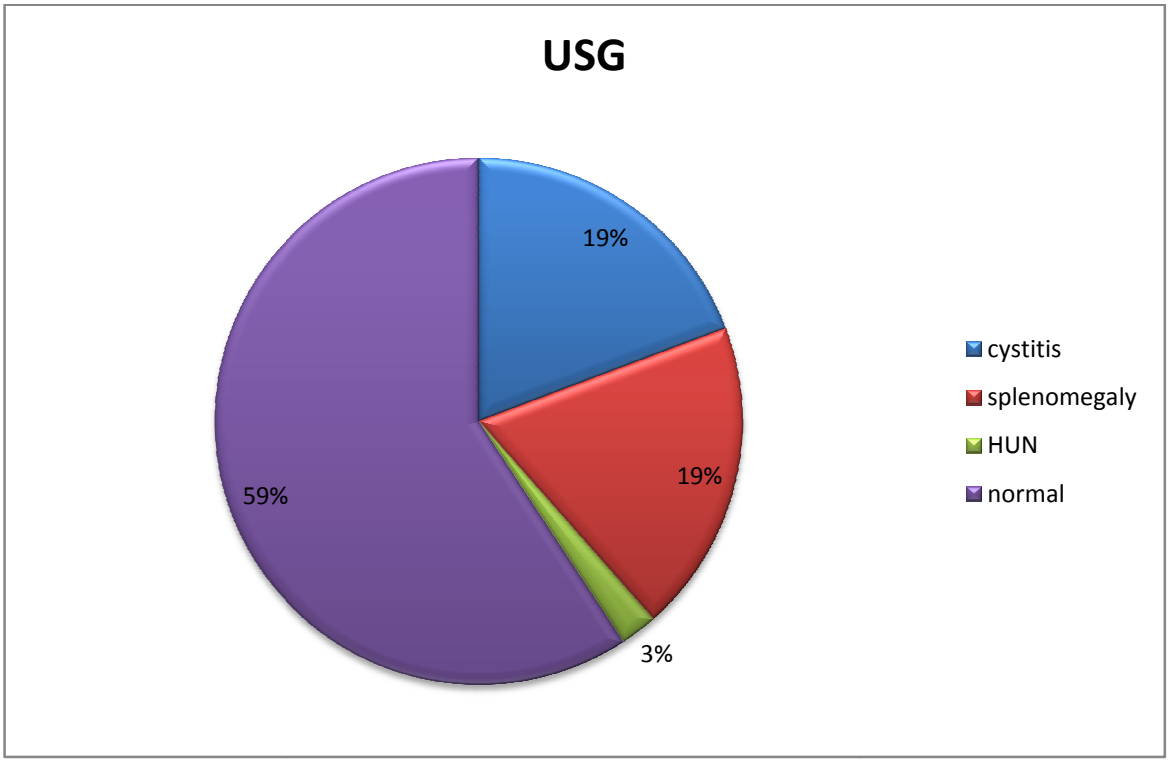


CHART 19 - USG

Voiding cysto urethrogram

TABLE 17 - VCUG

M C U	n	%
Abnormal	4	6%
Normal	62	94%

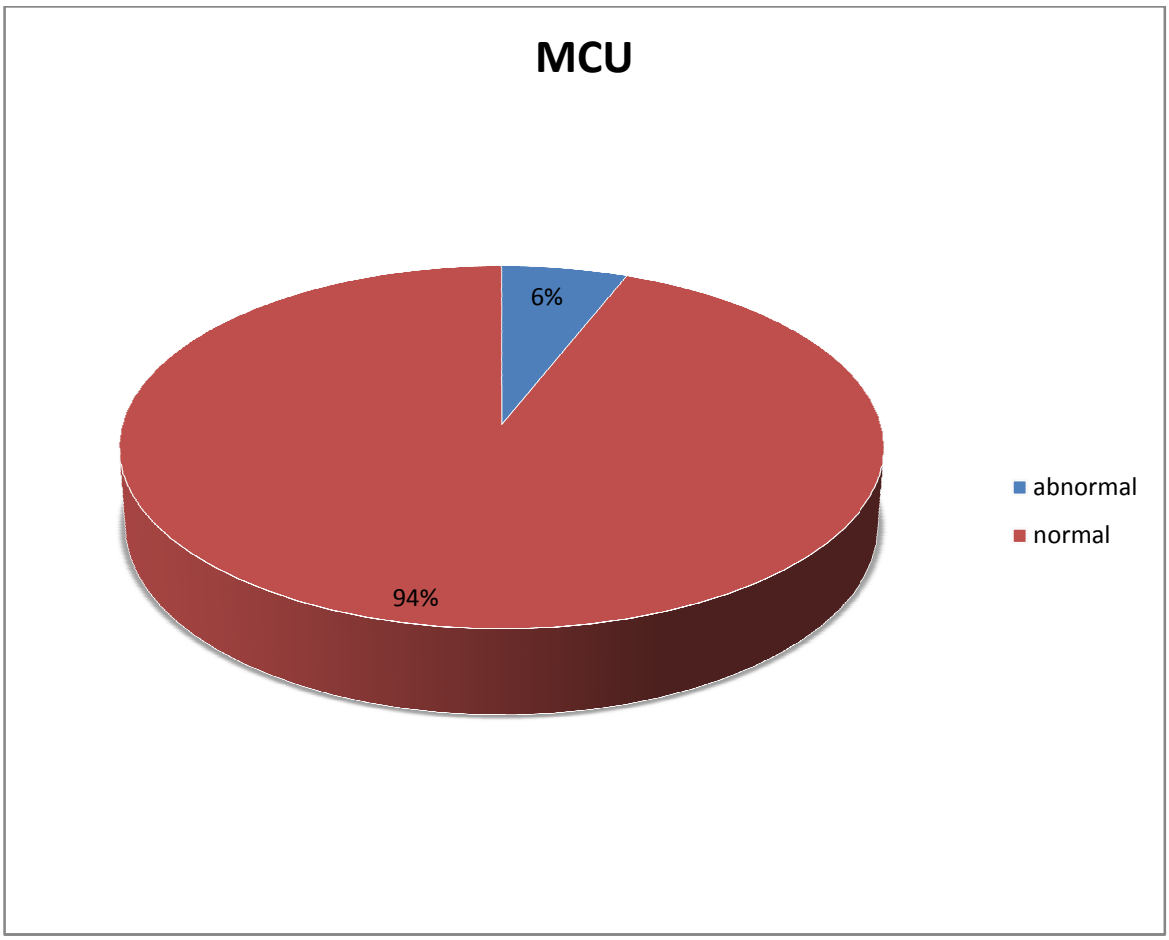


CHART 20 - VCUG

Hospital stay and outpatient treatment

43 patients were treated as outpatients which was around 20.1% of total.

Febrile toxic patients or patients with vomiting were treated as inpatients for the need of parenteral antibiotics. 171 patients were totally hospitalised from the study group which was 79.9% of the total.

<3 days parenteral antibiotic requirement and hence hospitalisation for the same was in 42 children constituting 19.6%.

3 to 7 days hospitalisation was required in 96 children constituting the major group of 44.9%. Most patients required 5 days parenteral antibiotic for symptom resolution.

>7 days treatment was required in 33 children which was around 15.4%. Least number of children required more than 1 week hospitalisation.

TABLE 18 – HOSPITAL STAY

HOSPITAL STAY	n	%
<3 days	42	19.6%
3-7 days	96	44.9%
>7 days	33	15.4%
Out patient	43	20.1%

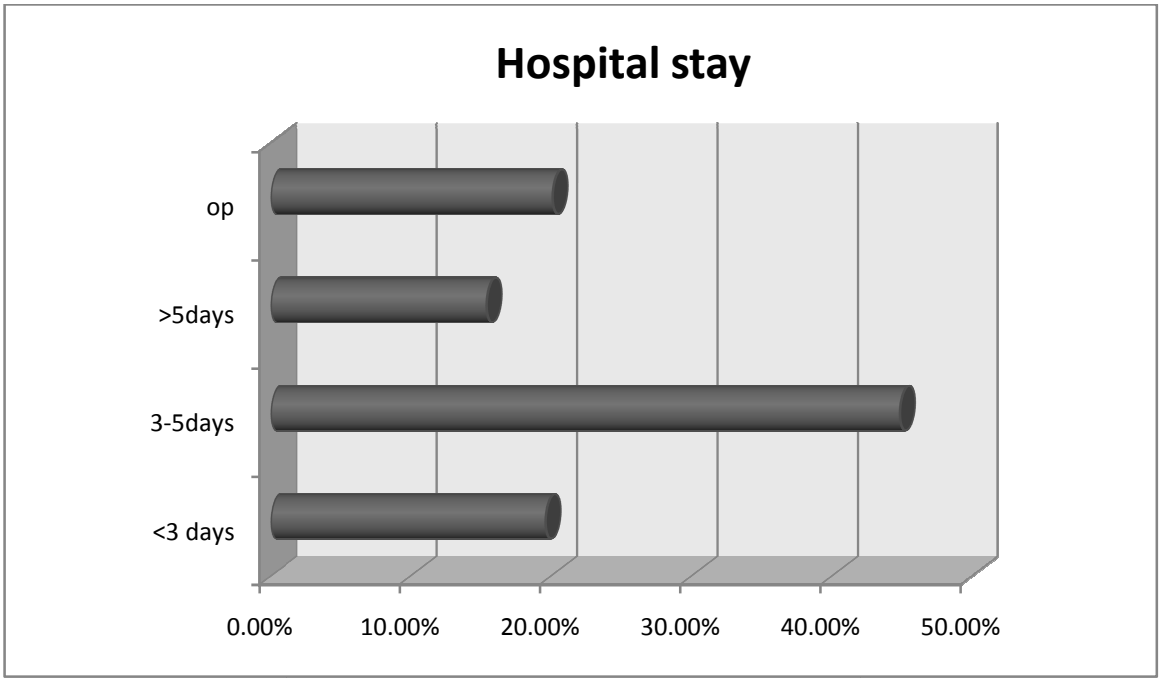


CHART 21 – HOPITAL STAY

Risk factor analysis

Circumcision was done in 31 children in control group and 17 children in cases. Uncircumcised males are more in cases than in control but this was not statistically significant.

TABLE 19 - CIRCUMCISSION

Circumcision (boys)	Control	Cases	Significance	
Done	31	17	X^2	p
Not done	91	111	5.923	0.15
Total	122	128		

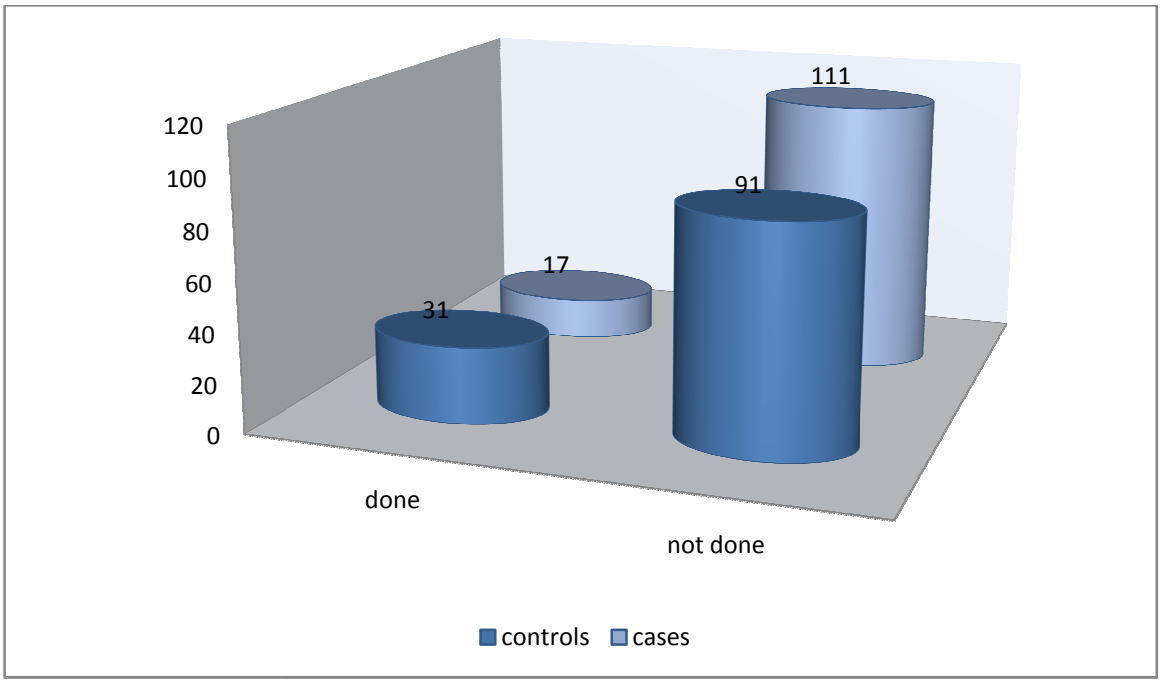


CHART 22 - CIRCUMCISSION

Recent hospitalisation history was more in cases (20) than in controls (16) but this not statistically significant.

TABLE 20 – RECENT HOSPITALISATION

Recent hospitalisation	Control	Cases	Significance	
Yes	16	20	X^2	p
No	190	194	0.334	0.563
Total	206	214		

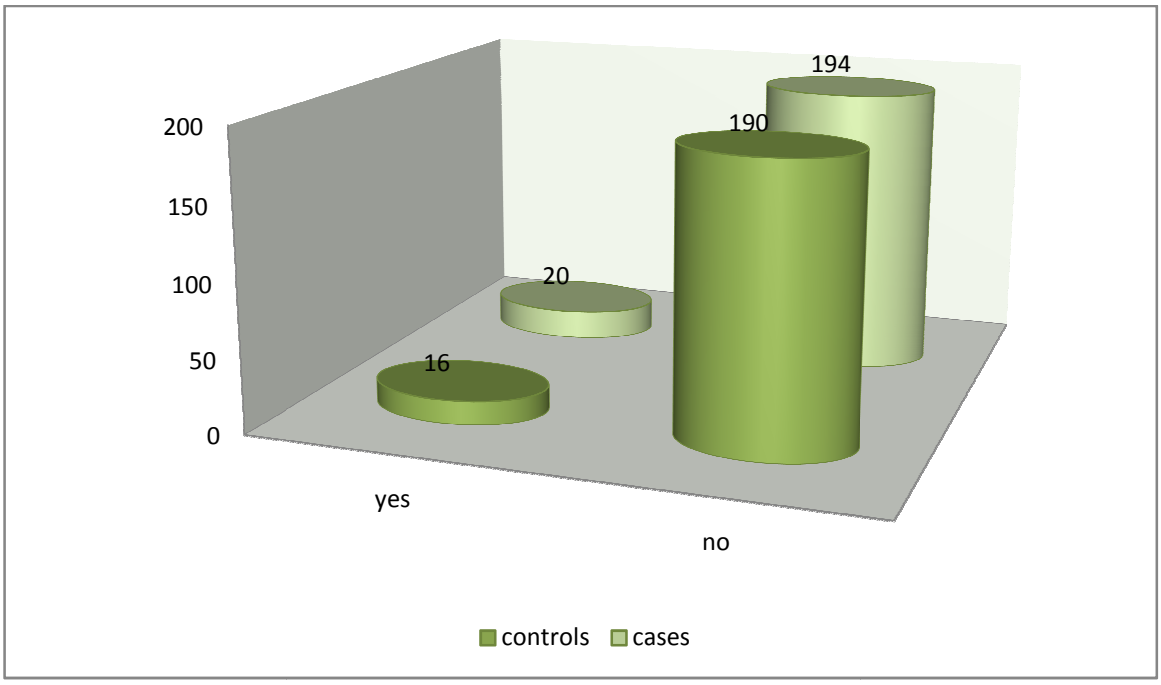


CHART 23 – RECENT HOSPITALISATION

Recent catheterisation history was not there in controls but was present in one case. This difference is statistically insignificant.

TABLE 21 – RECENT CATHETERISATION

Recent catheterisation	Control	Cases	Significance	
Yes	0	1	X^2	p
No	206	213	0.965	0.326
Total	206	214		

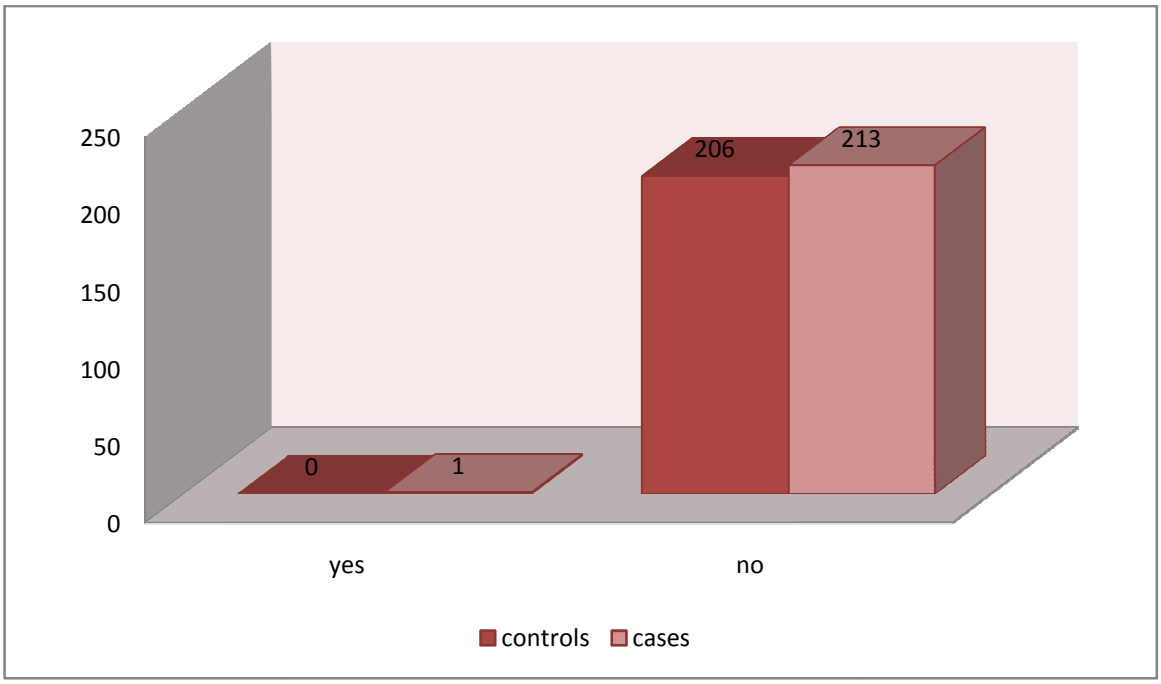


CHART 24 – RECENT CATHETERISATION

Usage of common toilet history was there in 42 cases and 30 controls, that is more in cases but this difference is statistically not significant.

TABLE 22 – COMMON TOILET USAGE

Common toilet	**Control**	**Cases**	**Significance**	
Yes	30	42	X^2	p
No	176	172	1.894	0.169
Total	206	214		

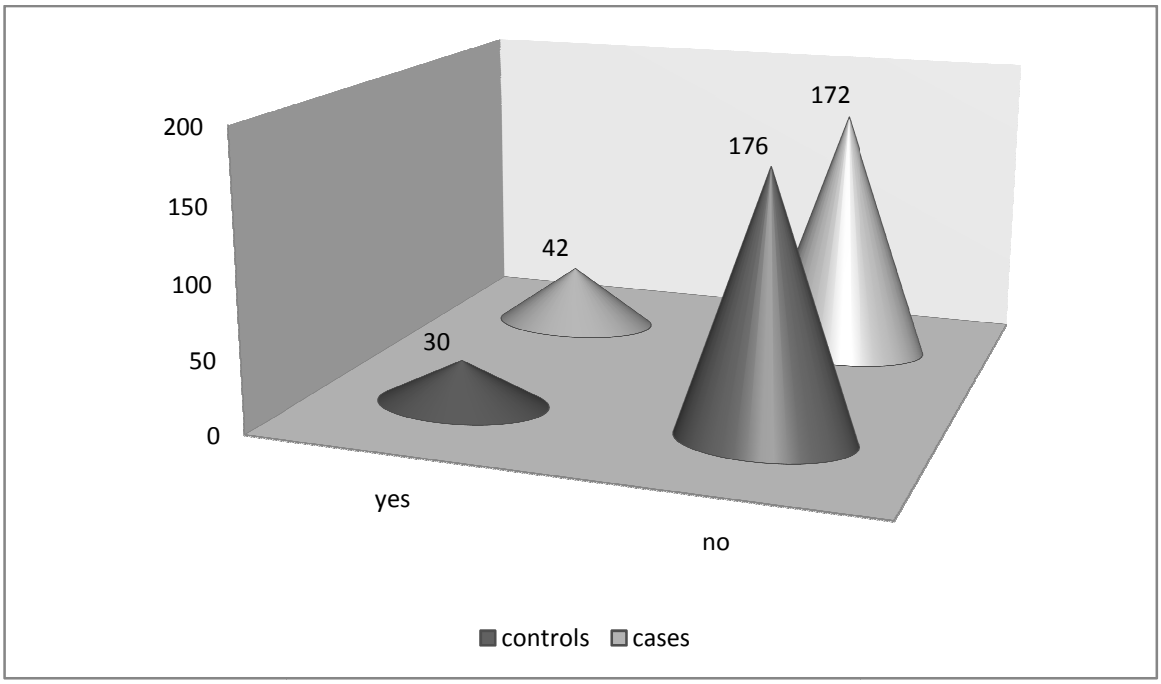


CHART 25 – COMMON TOILET USAGE

Cleaning back to front after toilet usage was there in 15 cases and 4 controls. This difference was statistically significant as a risk factor for UTI.

TABLE 23 – CLEANING BACK TO FRONT

Cleaning back to front (girls)	**Control**	**Cases**	**Significance**	
Yes	4	15	X^2	p
No	80	71	6.882	***0.009***
Total	84	86		

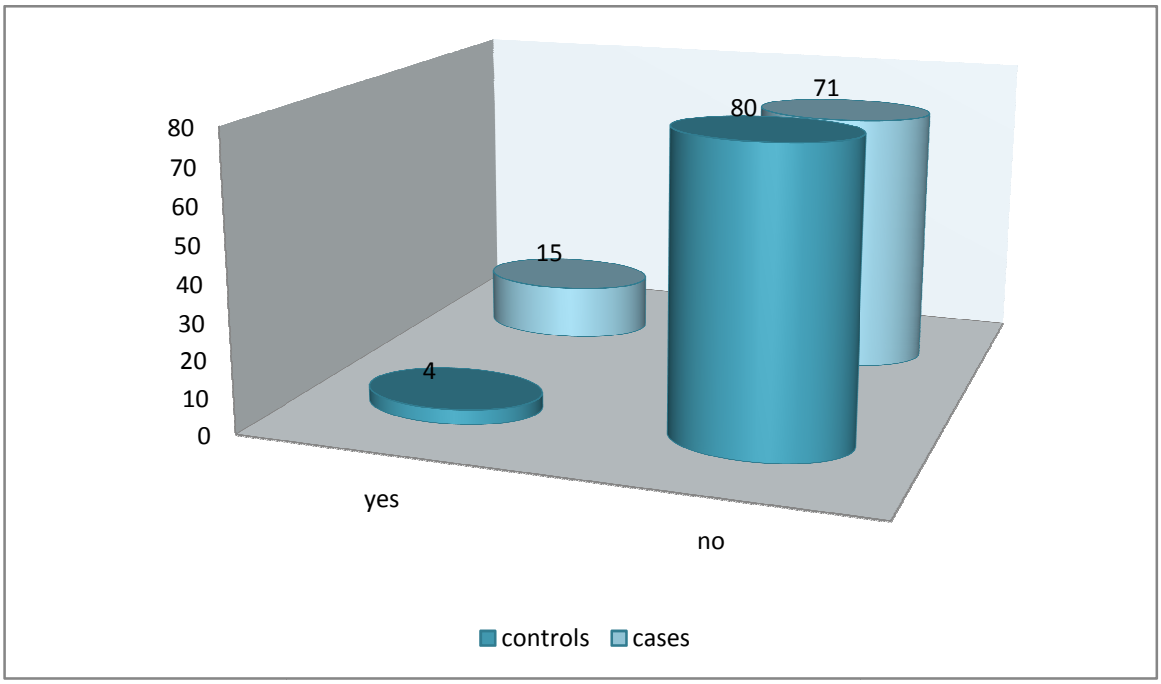


CHART 26 – CLEANING BACK TO FRONT

Constipation history was more in cases for 39 cases and only in 7 controls. This difference was statistically significant.

TABLE 24 - CONSTIPATION

Constipation	Control	Cases	Significance	
Yes	7	39	X^2	p
No	199	175	23.659	***0.000***
Total	206	214		

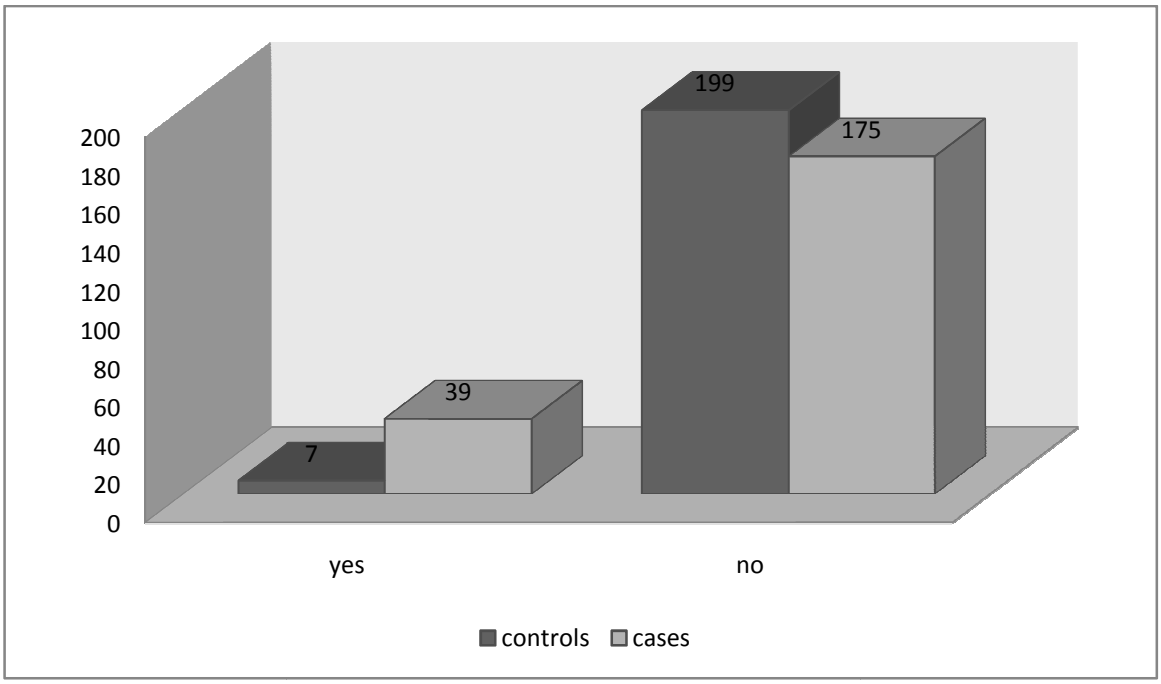


CHART 27 - CONSTIPATION

Usage of tight underclothing was told by 4 controls and 2 cases. This difference was not statistically significant.

TABLE 25 – TIGHT UNDERCLOTHING

Tight underclothing	Control	Cases	Significance	
Yes	4	2	X^2	p
No	202	212	0.756	0.385
Total	206	214		

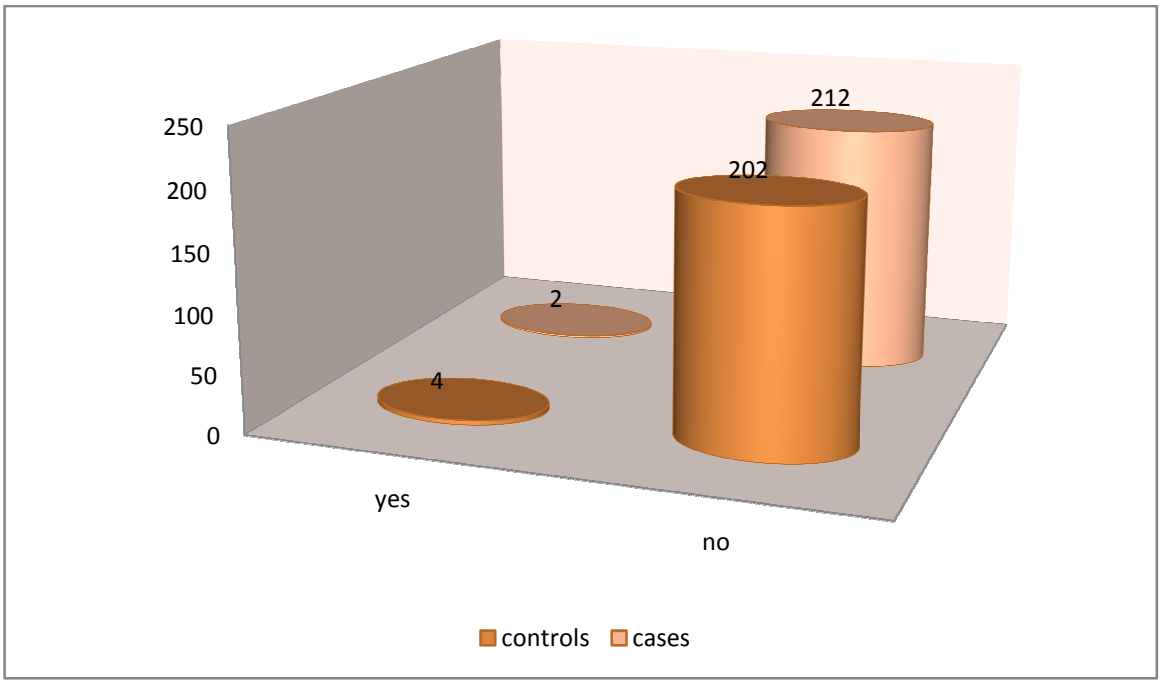


CHART 28 – TIGHT UNDERCLOTHING

Diaper usage was more in cases (17) than in controls (14) but it is not statistically significant difference.

TABLE 26 – DIAPER USAGE

Diaper usage	**Control**	**Cases**	**Significance**	
Yes	14	17	X^2	p
No	192	197	0.202	0.653
Total	206	214		

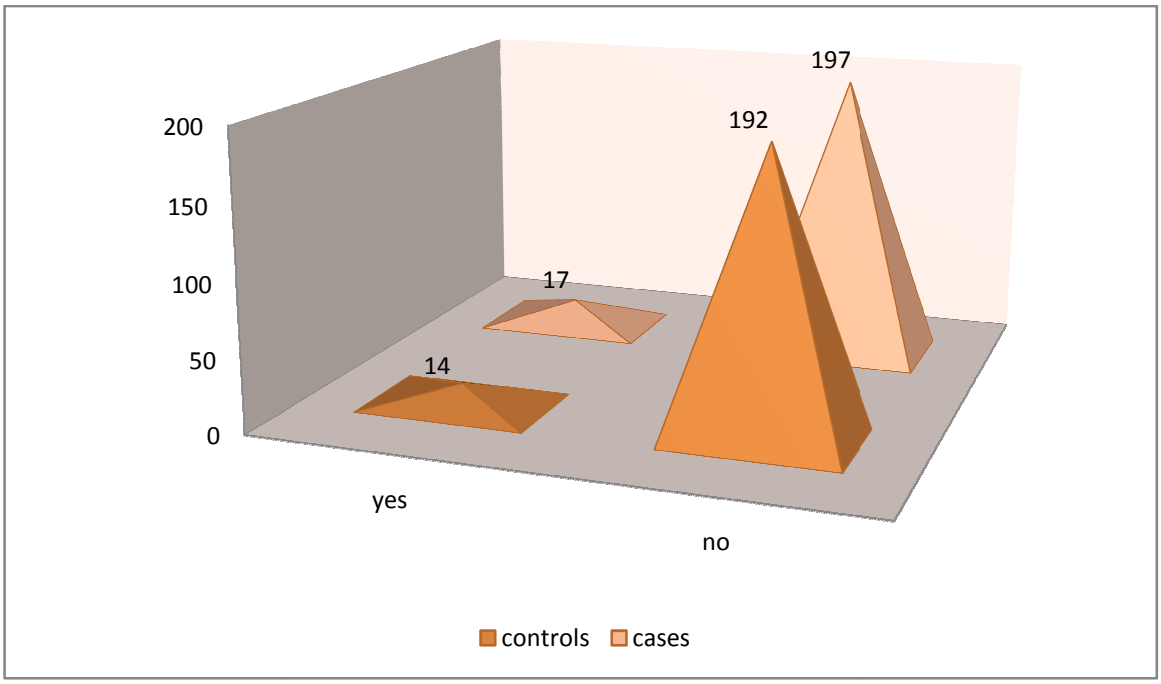


CHART 29 – DIAPER USAGE

Worm infestation history was told by more children from cases group (56) than in control group (34) and this difference was statistically significant.

TABLE 27 – WORM INFESTATION

Worm infestation	**Control**	**Cases**	**Significance**	
Yes	34	56	X^2	p
No	172	158	5.821	***0.016***
Total	206	214		

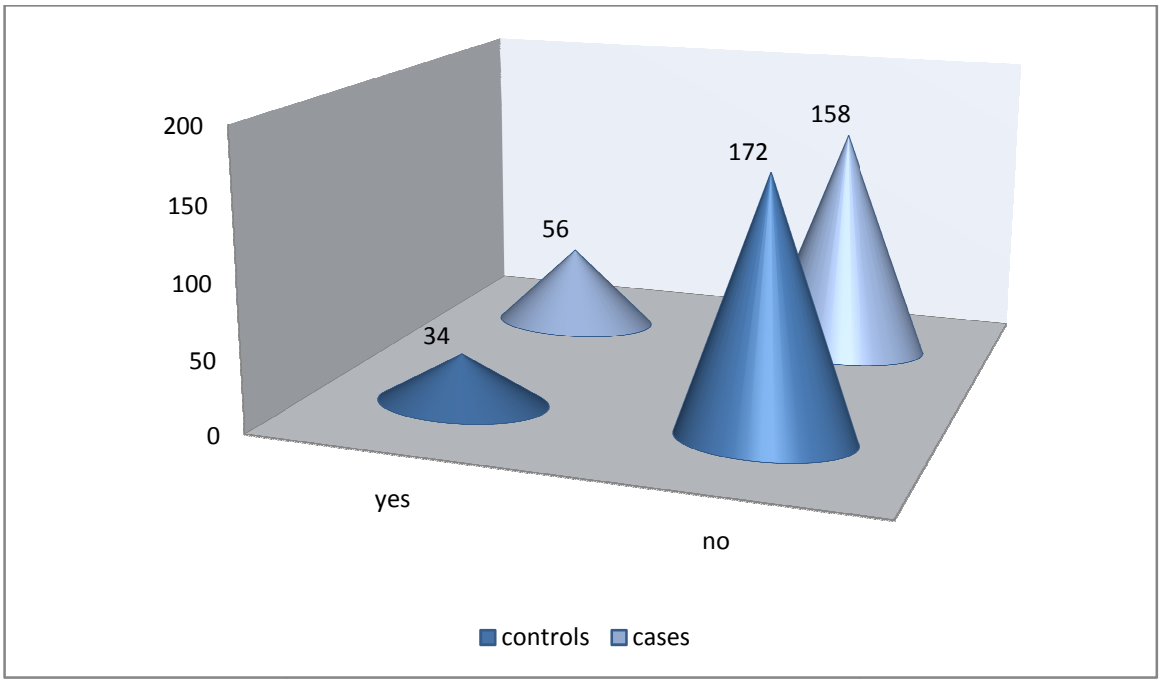


CHART 30 – WORM INFESTATION

Neurological abnormality was noticed in 8 cases and 2 controls and this was an insignificant statistical difference.

TABLE 28 – NEUROLOGICAL ABNORMALITY

Neurological abnormality	**Control**	**Cases**	**Significance**	
Yes	2	8	X^2	p
No	204	206	3.459	0.063
Total	206	214		

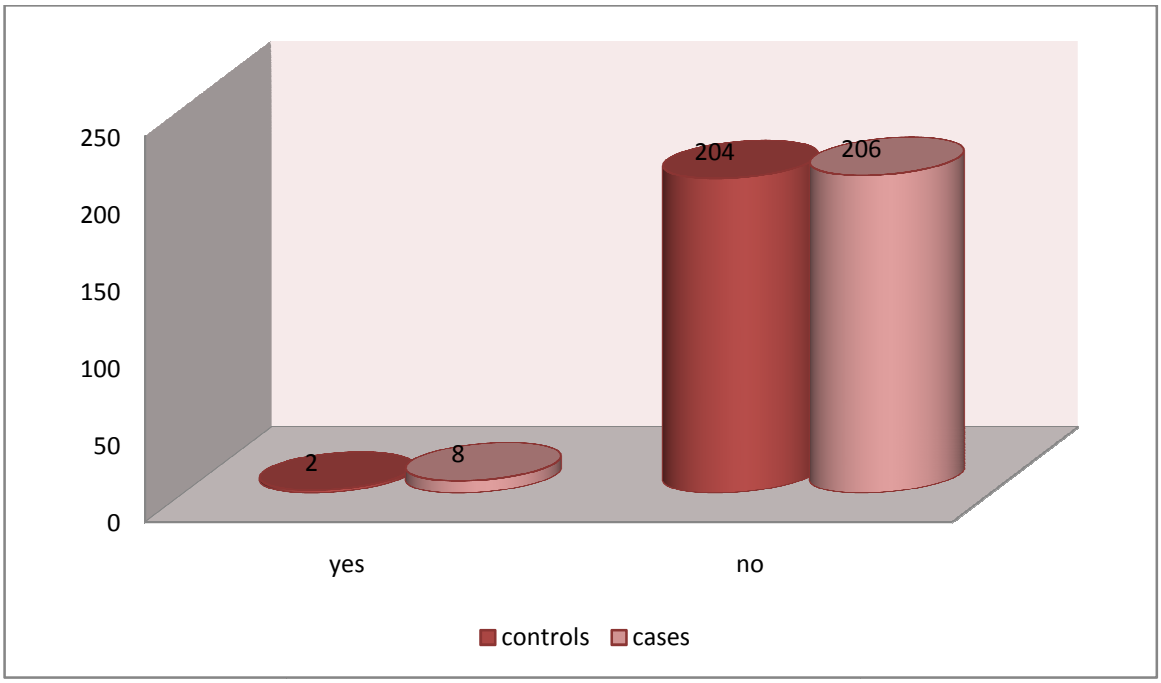


CHART 31 – NEUROLOGICAL ABNORMALITY

History of voluntary withholding of urine was there in 72 children from cases group and it is only 8 in children from control group. This difference was statistically significant.

TABLE 29 – VOLUNTARY WITHHOLDING OF URINE

Voluntary withholding of urine	**Control**	**Cases**	**Significance**	
Yes	8	72	X^2	p
No	198	142	60.293	***0.000***
Total	206	214		

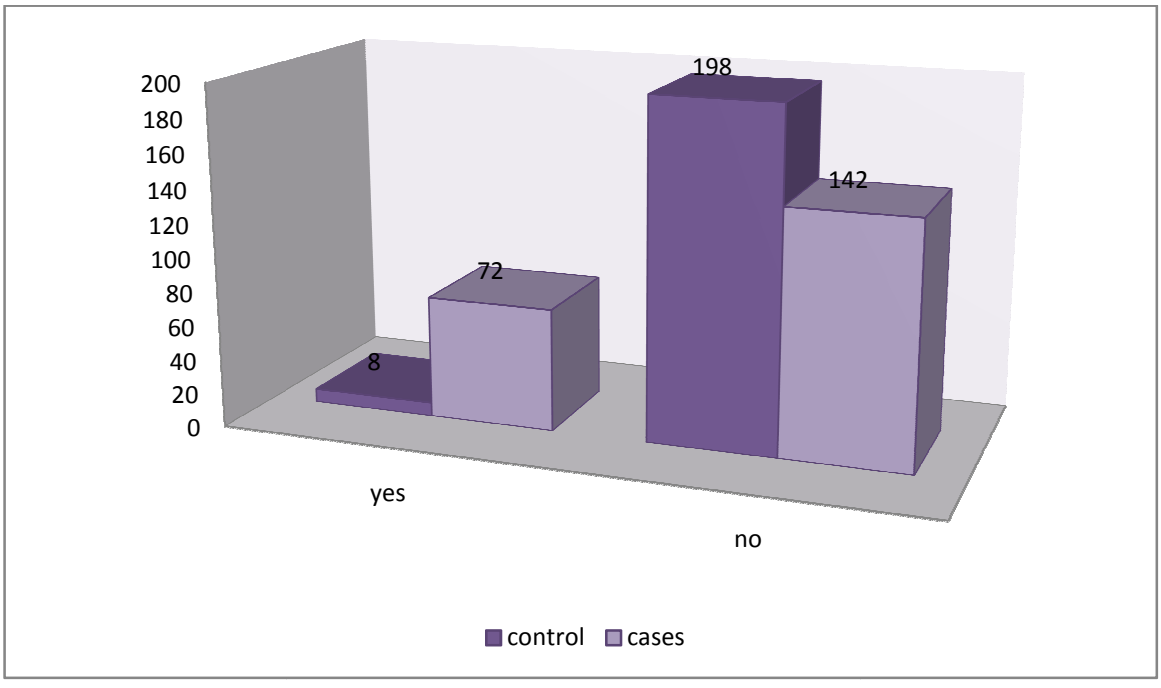


CHART 32 – VOLUNTARY WITHHOLDING OF URINE

Reduced water intake was there in by 74 cases which was more than 20 from control group. This difference was statistically significant.

TABLE 30 – REDUCED WATER INTAKE

Reduced water intake	**Control**	**Cases**	**Significance**	
Yes	20	74	X^2	p
No	186	140	37.373	***0.000***
Total	206	214		

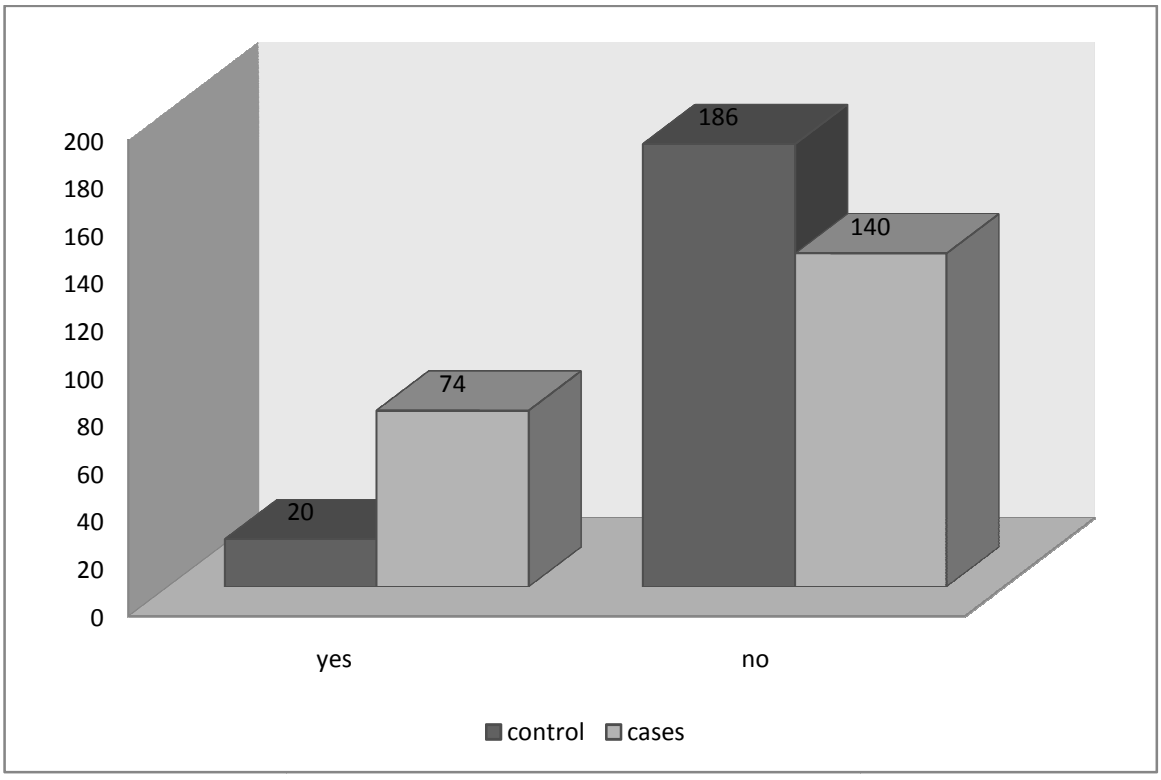


CHART 33 – REDUCED WATER INTAKE

Logistic regression analysis for risk factors

TABLE 31 – BINARY LOGISTIC REGRESSION ANALYSIS

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I.for EXP(B)	
							Lower	Upper
REC_HOS	-.013	.416	.001	1	.975	.987	.437	2.231
REC_CAT	17.406	40192.970	.000	1	1.000	36265960.436	.000	.
COM_TOI	.299	.310	.934	1	.334	1.349	.735	2.476
CONSTIPA	**1.734**	**.458**	**14.331**	**1**	***.000***	**5.661**	**2.307**	**13.890**
TIG_UND	-.140	.985	.020	1	.887	.869	.126	5.986
DIA_USA	.399	.446	.800	1	.371	1.490	.622	3.567
WORM_INF	**.714**	**.286**	**6.211**	**1**	***.013***	**2.041**	**1.165**	**3.578**
NEU_ABN	.906	.940	.929	1	.335	2.474	.392	15.605
VOL_WH	**2.641**	**.407**	**42.164**	**1**	***.000***	**14.024**	**6.320**	**31.119**
RED_WAT	**1.661**	**.305**	**29.595**	**1**	***.000***	**5.267**	**2.895**	**9.583**
Constant	-.844	.763	1.222	1	.269	.430		

TABLE 32 – CLASSIFICATION TABLE

Observed		Predicted		
		Group		Percentage Correct
		Control	Cases	
Group	Control	168	38	81.6
	Cases	72	142	66.4
Overall Percentage				***73.8***

When binary logistic regression analysis was done for risk factors between cases and controls constipation, worm infestation, voluntary withholding of urine and reduced water intake were found to be significant risk factors causing urinary tract infection.

With this analysis 73.8% of children were correctly classified.

Discussion

In this study urinary tract infection occurred more in male children than in female children. Studies done elsewhere and literature do not support this. The probable reason for this difference is that the study being hospital based the proportion of male and female children attending our hospital may be different.

In this study majority of children belonged to low socio economic status and were from urban area and the analysis is targeted to this group of the community.

On analysing the clinical profile of the study group fever was the most common presenting symptom with 64.8% of the children presenting with it. This is followed by increased frequency of urination which was seen in 51.9%. The third common symptom was abdominal pain which constituted 45.8%.

This is similar to other study by ***A Sharma et al***[113] which included children from two months to fifteen years conducted in Nepal except that the second common presentation was abdominal pain.

In a study by ***April Gamier Bay et al***[117] taking all children with Urinary infection coming to outpatient department at Philippines also showed

fever as the most common presentation and abdominal pain as the second common one.

Malla KK et al[114]***, Islam MN et al***[115] and ***Brkic S et al***[116] showed fever as most common presenting complaint in their studies.

TABLE 33 – COMPARISON OF SYMPTOMS

SYMPTOM	Present study	A Sharma et al	April Gamier et al	Qureshi AM et al
Fever	64.8%	65%	63.6%	92%
Increased frequency of urination	51.9%	37.5%	57%	-
Abdominal pain	41.8%	42.5%	12.1%	
Dysuria	40.2%	-	-	68%
Vomiting	22%	20%	-	-

In a study by ***Qureshi AM et al*** [118] fever was the most common presentation but percentage was very high (92%) and dysuria was second

common presentation with 68% of children presenting with it. This study involved children up to fifteen years of age at Abbottabad.

Recurrent urinary tract infection was present in 7% of children. Out of this 7% 93.3% children had same organism grown in their urine culture suggesting unresolved or persistent bacteriuria. This is comparable with the literature stating unresolved bacteriuria as the most common type of recurrent UTI.[78]

Supra pubic tenderness was the most common clinical finding but it was seen only in 39.3% of children. Majority of children presented as fever without focus in correlation with literature. All children with supra pubic tenderness didn't have cystitis in USG and all children with cystitis didn't have supra pubic tenderness.

Transient hypertension was present in one child and it resolved with treatment of the infection.

None of the children had external urogenital malformation. This may be because children <2 years were excluded from the study.

Among bed side tests pyuria was present in 36% of the children. This is similar to the study by ***April Gamier Bay et al***[117] in which 35.2% children had pyuria.

Among laboratory findings 38.3% children had leukocytosis. This was the most common presentation and none of the children had elevated urea and creatinine.

Most common causative organism was E. coli (45.8%) followed by Klebsiella, Proteus and Pseudomonas constituting 23.8%, 9.8% and 6.1% respectively. This is comparable with the study by ***A Sharma et al***[113] from Nepal and ***Akram M et al*** [119] from Aligarh, India.

TABLE 34 – COMPARISON OF ETIOLOGY

ORGANISM		A Sharma et al	Akram M et al
E. coli	45.8%	67.5%	61%
Klebsiella	23.8%	20%	22%
Proteus	9.8%	10%	
Psedomonas	6.1%	2.5%	4%

Studies by ***Mantadakis E et al***[120] and ***Islam M et al***[115] showed E. coli as most common organism but with varying proportions.

Sensitivity to antimicrobials showed that 92% of the organisms were sensitive to Amikacin whatever may be the organism and 69.6% sensitive to Gentamycin and Cefotaxime. Among oral antibiotics 62.1% of

organisms were sensitive to cotrimoxazole and 41.5% to Norfloxacin. In our hospital when there is a situation to start empirical antibiotic awaiting culture and sensitivity report Amikacin can be the preferred parenteral drug and cotrimoxazole oral drug.

Among imaging studies ultrasound abdomen detected 19.6% with cystitis, 19.6% with splenomegaly and 2.3% with hydronephrosis. Only 2.3% of children with urinary tract infection had abnormality in USG.

VCUG was normal in 94% of children who underwent this imaging. Among 2-5 years group 96.8% had normal VCUG and the rest 3.2% had abnormal USG. So instead of subjecting all children <5 years to VCUG, it can be done only if USG is abnormal as it is done for children >5 years. As <2 years were not included in the study there could be a bias in anomaly detection. So larger studies including all children <5 years is needed to say that routine VCUG is not required.

In the risk factors analysis worm infestation, constipation, voluntary withholding of urine and reduced water intake had statistically significant difference from the controls. This is comparable with literature stating "Drink plenty and don't hold on". [30]

It is also comparable with ***Mazzola BL et al*** [121] in which withholding urine, reduced fluid intake, constipation were found to be predisposing UTI in girls aged between 3.8 – 18 years. Study also suggested that poor genital hygiene and toilet habits were almost always associated with other factors and so not necessarily predispose UTI.

In studies by ***Loening-Baucke V et al***[26] and ***Koff SA et al***[27] constipation and infrequent voiding were found to be risk factors for UTI. Cleaning back to front was not demonstrated as a risk factor.

Limitations

- This being a hospital based study demography and socio economic class of urinary tract infection children may be biased. A community based study is required to know the exact demographic profile.
- <2 years children are not included in the study. Hence symptoms, signs and risk factors analysed doesn’t reflect the entire paediatric population.
- Only limited antibiogram was used to assess the sensitivity pattern

Conclusion

The study group in which the risk factors were analysed had a male preponderance and belonged to low socio economic class. In our study population fever and increased frequency are two important symptoms followed by abdominal pain. Recurrent infection was most often due to unresolved bacteriuria or persistent bacteriuria than reinfection. Signs like supra pubic tenderness and hypertension are very rare. Common organisms causing urinary tract infection in our study population are E. coli followed by Klebsiella, proteus and pseudomonas. Amikacin sensitivity is the highest among the isolates in the study population and it can be recommended as the drug of choice for UTI. In this study USG abnormality was present in 2.3% of patients in age group between 2 to 12 years and renal ultrasound is mandatory for identifying structural abnormalities so that further investigations can be done. A voiding cysto urethrogram abnormality was present only if there was USG abnormality in 2-5years children. This study also restates the fact that VCUG may not be required for all patients with UTI in 2 to 5 years of age instead it can be reserved for patients who have got USG abnormality. In this study worm infestation, constipation, voluntary withholding of urine and reduced water intake were found as risk factors for UTI which is similar to other studies.[26, 27, 121]

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ABBRIEVATIONS

UTI – urinary tract infection

E. coli – Escherichia coli

NICE – National Institute for Health and Clinical Excellence

USG – ultrasonogram

DMSA – dimercapto succinic acid

VCUG – voiding cysto urethrogram

MCU – micturating cysto urethrogram

VUR – vesico ureteric reflux

IAP – Indian Academy of Paediatrics

AAP – American Academy of Pediatrics

PROFOMA

Name : Code:

Mother's name : Ip no:

Father's name : SEC:

Address : Age:

Circumcission :

Recent hospitalisation :

Recent catheterisation :

Common toilet :

Cleaning habits :

Constipation :

Tight underclothing :

Diaper usage :

Worm infestation :

Neurological abnormality :

Voluntary withholding of urine :

Reduced water intake :

Fever :

No of days :

Chills and rigor :

Burning micturition :

Increased frequency of

Micturition :

High coloured urine :

Cloudy urine :

Abdominal pain :

Vomiting :

Preputial bulging :

Enuresis :

Previous UTI :

No of episodes :

Growth retardation :

Phimosis :

Vaginal synechiae :

Other external malformation :

Edema :

Renal angle tenderness :

Supra pubic tenderness :

Hypertension :

CBC Hb :

TC :

DC :

ESR :

RFT Urea :

Creatinine :

Urine albumin :

Urine deposit :

Mantoux :

Organism :

Sensitivity :

USG :

MCU :

Hospital stay :

CASES

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	2	1	1	2	1	2	2	2	NA	2	2	2	1	2	2	2	2	1	2	1	2	2	2	2	2	2	3	2	2	2	2	2	2	1	2	2	2	1	2
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CONTROLS

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612	2	1	1	1	2	2	2	2	NA	1	2	2	2	2	2	2
613	2	1	2	1	1	2	2	2	NA	2	2	2	2	2	2	2
614	2	1	1	1	2	2	2	2	NA	2	2	2	2	2	2	2
615	2	2	1	1	NA	2	2	2	2	2	2	2	1	2	2	2
616	1	1	1	2	2	2	2	2	NA	2	2	2	2	2	2	2
617	1	2	2	1	NA	2	2	1	2	2	2	1	2	2	2	2
618	2	1	2	1	2	2	2	2	NA	2	2	2	2	2	2	2
619	1	1	2	1	1	2	2	2	NA	2	2	2	2	2	2	2
620	2	1	2	1	1	1	2	2	NA	2	2	2	2	2	2	2
621	2	1	1	1	2	2	2	2	NA	2	2	2	1	2	2	2
622	2	2	3	2	NA	2	2	2	2	2	2	2	2	2	2	2
623	1	1	2	1	2	2	2	1	NA	2	2	2	2	2	2	2
624	1	1	1	1	2	2	2	2	NA	2	2	2	2	2	2	2
625	1	2	2	1	NA	2	2	2	2	2	2	2	2	2	2	2
626	1	1	1	2	1	2	2	1	NA	2	2	2	2	2	2	1
627	2	2	2	1	NA	2	2	2	2	2	2	2	1	2	2	1
628	2	2	2	1	NA	2	2	2	2	2	2	2	1	2	2	2
629	2	1	2	1	2	2	2	2	NA	2	2	2	2	2	2	2
630	2	1	1	1	1	2	2	2	NA	2	1	2	2	2	2	2
631	2	1	3	1	2	2	2	1	NA	2	2	2	2	2	2	2

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633	2	2	2	1	NA	2	2	2	2	2	2	2	2	2	1	2
634	2	2	1	1	NA	2	2	2	2	2	2	2	2	2	2	2
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636	2	1	1	2	1	2	2	2	NA	2	2	2	2	2	2	2
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641	1	2	2	1	NA	1	2	2	2	2	2	2	2	2	2	2
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644	1	1	1	1	1	2	2	2	NA	2	2	2	2	2	2	1
645	2	2	2	1	NA	2	2	1	2	2	2	2	1	2	2	2
646	1	2	1	2	NA	2	2	2	2	2	2	2	2	2	2	2
647	2	1	3	1	2	2	2	2	NA	2	2	2	2	2	2	2
648	2	2	2	1	NA	1	2	2	2	2	2	2	2	2	2	1
649	2	1	2	1	2	2	2	2	NA	2	2	2	2	2	2	2
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651	2	2	2	1	NA	2	2	2	2	2	2	2	2	2	2	2
652	2	2	3	2	NA	2	2	2	2	1	2	2	2	2	2	2
653	2	2	2	1	NA	2	2	2	2	2	2	2	2	2	2	2
654	2	2	1	1	NA	2	2	2	2	2	2	2	2	2	2	2
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656	1	1	1	2	1	2	2	1	NA	2	2	2	2	2	1	2
657	2	2	2	1	NA	2	2	2	2	2	2	2	2	2	2	2
658	1	2	3	2	NA	2	2	2	2	2	2	1	2	2	2	2
659	2	2	3	1	NA	1	2	2	2	2	2	2	2	2	2	2
660	2	1	2	1	1	2	2	2	NA	2	2	2	2	2	2	1
661	2	1	1	1	2	1	2	2	NA	2	2	2	1	2	2	2
662	2	2	3	1	NA	2	2	2	1	2	2	2	2	2	2	2
663	2	2	2	1	NA	2	2	2	2	2	2	2	2	2	2	2
664	1	1	1	2	2	2	2	2	NA	2	2	2	2	2	2	2

665	2	1	2	1	2	2	2	2	NA	2	2	2	2	2	2	2
666	1	2	1	1	NA	2	2	2	2	2	2	2	2	2	2	2
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669	2	2	2	1	NA	2	2	2	2	2	2	2	2	2	2	2
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671	1	2	2	1	NA	1	2	2	2	2	2	2	1	2	2	2
672	1	2	1	1	NA	2	2	2	2	2	2	2	2	2	2	2
673	2	1	2	1	2	2	2	2	NA	2	2	2	2	2	2	2
674	2	1	2	1	1	2	2	2	NA	2	2	2	2	2	2	2
675	1	1	2	2	1	2	2	2	NA	2	2	2	2	2	2	1
676	2	1	2	2	2	2	2	1	NA	2	2	2	1	2	1	2
677	2	2	1	1	NA	1	2	2	2	2	2	2	2	2	2	2
678	1	2	3	1	NA	2	2	2	2	2	2	2	2	2	2	2
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681	2	1	2	1	2	2	2	2	NA	2	2	2	2	2	2	2
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696	2	2	1	1	NA	2	2	2	2	2	2	2	2	2	2	2
697	2	1	2	1	2	2	2	1	NA	2	2	2	2	2	2	2

698	2	2	3	1	NA	2	2	2	2	2	2	2	2	2	2	2
699	1	2	2	1	NA	2	2	2	2	2	2	2	2	2	2	2
700	2	1	1	1	1	1	2	2	NA	2	2	2	2	2	2	2
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703	2	1	1	1	2	2	2	2	NA	2	2	2	2	2	2	2
704	1	2	3	1	NA	2	2	2	2	2	2	2	2	2	2	2
705	2	2	2	1	NA	2	2	2	2	2	2	2	2	2	2	2
706	2	1	1	1	2	2	2	2	NA	2	2	2	2	2	2	2

KEY TO MASTER CHART

NA	Not applicable
A – Code	
B - Age	1(2-5yrs)/2(5-12yrs)
C - Sex	1(male)/2(female)
D - SEC	1(class 5)/2(class 4)/3(class 3)
E - Locality	1(urban)/2(rural)
F - Circumcision	1(done)/2(not done)
G - Recent hospitalisation	1(yes)/2(no)
H - Recent catheterisation	1(yes)/2(no)
I - Common toilet	1(yes)/2(no)
J - Cleaning back to front	1(yes)/2(no)

K - Constipation	1(yes)/2(no)
L - Tight underclothing	1(yes)/2(no)
M - Diaper usage	1(yes)/2(no)
N - Worm infestation	1(yes)/2(no)
O - Neurological abnormality	1(yes)/2(no)
P - Voluntary withholding	1(yes)/2(no)
Q - Reduced water intake	1(yes)/2(no)
R - Fever	1(<3days)/2(3- 5days) /3(>5days) /4(no)
S - Chills & rigor	1(yes)/2(no)
T - Burning micturition	1(yes)/2(no)
U - Increased frequency	1(yes)/2(no)
V - High colored urine	1(yes)/2(no)

W - Cloudy urine	1(yes)/2(no)
X - Abdominal pain	1(yes)/2(no)
Y - Vomiting	1(yes)/2(no)
Z - Preputial bulging	1(yes)/2(no)
AA - Enuresis	1(yes)/2(no)
AB - Previous UTI	1(1episode)/2(>1episode)/3(no)
AC - Growth retardation	1(yes)/2(no)
AD - Phimosis	1(yes)/2(no)
AE - Vaginal synechiae	1(yes)/2(no)
AF - Malformations	1(yes)/2(no)
AG - Edema	1(yes)/2(no)
AH - Renal angle tenderness	1(yes)/2(no)
AI - Supra pubic tenderness	1(yes)/2(no)

AJ - Hypertension	1(yes)/2(no)
AK - Anaemia	1(yes)/2(no)
AL - High ESR	1(yes)/2(no)
AM - WBC	1(leukocytosis)/2(leukopenia)/ 3(normal)
AN - Urea	1(yes)/2(no)
AO - Creatinine	1(yes)/2(no)
AP - Proteinuria	1(yes)/2(no)
AQ - Pyuria	1(yes)/2(no)
AR - Hematuria	1(yes)/2(no)
AS - Mantoux	1(yes)/2(no)
AT - Organism	1(E. coli)/2(klebsiella)/3(proteus)/ 4(pseudomonas)/5(CONS)/6(staph. aureus)

	7(Enterococcus)/8(Citrobacter)
AU - USG	1(cystitis)/2(splenomegaly)/
	3(hydronephrosis)/4(normal)
AV- VCUG	1(abnormal)/2(normal)
AW - Hospital stay	1(PICU)/2(<3days)/3(3-7days)/
	4(>7days)
AX - Amikacin	1(yes)/2(no)
AY - Erythromycin	1(yes)/2(no)
AZ - Ampicillin	1(yes)/2(no)
BA - Cefotaxime	1(yes)/2(no)
BB - Ciprofloxacin	1(yes)/2(no)
BC - Norfloxacin	1(yes)/2(no)
BD - Septran	1(yes)/2(no)

BE - Cephelexin	1(yes)/2(no)
BF - Amoxicillin	1(yes)/2(no)
BG - Gentamycin	1(yes)/2(no)
BH - Vancomycin	1(yes)/2(no)